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JSPA Japan Society of Physiological Anthropology

PROCEEDING

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Occupational Health and Safety Trends and Challenges in Developing Countries

1st - 2nd November 2017 | Bali, Indonesia

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"OCCUPATIONAL HEALTH AND SAFETY TRENDS AND CHALLENGES IN DEVELOPING COUNTRIES"

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WELCOME MESSAGES

Dear all,

I take great pleasure in welcoming you to the 1st International Conference of Occupational Health and Safety (ICOHS) with theme Occupational Health and Safety Trends and Challenges in Developing Countries. This event was organized by Department of Occupational Health and Safety, Faculty of Public Health, Universitas Indonesia. As one of leading institution in OHS education in Indonesia, we would like to take part in strengthening the implementation of Occupational Health and Safety generally in Developing countries and particularly in Indonesia.

The vision of 1st ICOHS is becoming a mean for sustaining scientific atmosphere for scholars, academician, researchers, practitioners, and policy maker to share knowledge and best practice in implementing Occupational Health and Safety, particularly in developing countries. Thus, the missions are:

- To gather competent and experienced experts in the field of OHS
- To gather participants from Indonesia and other countries
- To increase credible scientific publications
- To provide an outstanding national and international OHS community on updating knowledge and methods in tackling OHS challenges

We are very happy that this conference has been widely accepted. Number of abstracts have been received and reviewed from at least 8 countries (Indonesia off course, Malaysia, Thailand, UK, Australia, US, Japan and Brunei Darussalam) which then divided into 58 poster presentations and 70 oral presentations. We would like to deliver our appreciation for those who has submitted their paper or joining this conference as participants. To all the speakers, thank you very much for your kind response in answering our invitation. To sponsors, we would like to express our appreciation for taking this event as a moment for sharing technology, information and dedication.

Please enjoy the conference, do not forget to breath some Bali's fresh air and have fun.

Sincerely,

Indri Susilowati Hapsari, PhD

Head Organizing Committee ICOHS

Head of Department of Occupational Health and Safety, Faculty of Public Health, Universitas Indonesia

It is a great honor for me to welcome you to the 1st International Conference of Occupational Health and Safety (ICOHS), organized by Department of Occupational Health and Safety, Faculty of Public Health, Universitas Indonesia. The theme of this conference is Occupational Health and Safety Trends and Challenges in Developing Countries. Since public health issue is strongly linked with workforce due to high number of worker in population at about 63%, we strongly believe that mitigating health and safety in occupational setting will directly impact to the health and safety of the population. Furthermore, development of occupational health and safety into public domain is another advantage in solving public health problems.

The implementation of Occupational Health and Safety Management system (OHSMS) in developing countries was known to be lagged behind than developed countries. Gaps and challenges can be shared and solved together in academic forum like ICOHS.

It is an honour for Universitas Indonesia (UI) to host this prestigious international conference. The conference program will be covering a range of topics in Occupational Health and Safety that would be both interesting and beneficial for the fellow participants. Moreover, the many presentations at this conference will address common issues and the problems faced by professionals in OHS. We hope that this conference will serve as a platform for all of us to learn and share as well as will help us create an environment of mutually rewarding scientific researches and collaborations that will benefit to the advances in OHS.

We also invite you to enjoy Bali, Paradise Island, where the natural landscape unites with spiritual temples and religious ceremony

I thank everyone for your participation at the 1st ICOHS.

Sincerely,

dr. Agustin Kusumayati, MSc, PhD

Dean Faculty of Public Health – Universitas Indonesia

Selamat datang,

Universitas Indonesia (UI) warmly welcomes all participants, speaker and our honourable guests to International Conference of Occupational Health and Safety, Faculty of Public Health, Universitas Indonesia, 2017.

The event is so much in accordance with the UI's mission to conduct the Tri Dharma (Education, Research and Community service) that is capable to meet the national and global challenges. Universitas Indonesia (UI) itself has determined to be a world class research university who sets its commitment to the academic invention and research activities through various scientific programs.

Faculty of Public Health UI decides to lift *Occupational Health and Safety Trends and Challenges in Developing Countries* as the theme of ICOHS, FPH UI. UI would like to nurture the students to take part early as possible in facing current public health issues and challenges as we realize we are counting our future to them. They are indeed our upcoming leaders.

We wish you a productive festival and conference. Spread ideas, gain knowledge, build network and develop a better world.

Sincerely,
Prof. Dr. Ir. Muhammad Anis, M.Met
Rector of Universitas Indonesia

DRIVER FATIGUE ON BUS APTB AND TRANSJAKARTA CORIDOR 8 IN JAKARTA

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Abstract

The National Transportation Safety Board, driver fatigue in the United States considered to bet he most important road safety factor because accounts for approximately 100.000 heavy vehicle accidents and 1.500 fatalities per year. Fatigue is a factor in an estimated 30 to 40 percent of heavy vehicle accidents and 15 percent of fatal. Fatigue causes a loss of alertness in a driver. Which is slower reaction time, decreased skill levels, a driver's ability to concentrate and make critical decisions is reduced, it takes longer to interpret and understand a traffic situation. It is a significant problem in the road transport sector in terms of the health and quality of life of drivers, as well as in the potential for accidents. The purpose of this study is to identify the difference of the average of work fatigue between APTB bus driver and Transjakarta bus coridor 8 on 2017. Cross Sectional methodology was chosen in this study. The population of this study were 30 respondents APTB bus drivers and 40 respondents from Corridor 8 Transjakarta bus drivers. The sampling method were using total sampling with 70 respondents. T-test independent was chosen for the statistical test and the result (p=0,000) shown a significant difference (p<0,05) in term of driver's fatigue. The conclusion for APTB and Transjakarta bus drivers is expected to be able to relax while waiting for passengers or rest and for APTB bus drivers it is necessary to set the working hours in one day by dividing the two work shifts.

Keywords: Fatigue, Driver Fatigue, APTB, Transjakarta

1. INTRODUCTION

Work fatigue is a condition of weakening activities, movements, and physical exhaustion to do work. According Cameron (1973) in Setyawati (2010), that work fatigue concerns the decrease of physical performance, the feeling of tiredness, decreased motivation, and decreased work productivity. Work fatigue occurs due to accumulation of lactic acid. At work the body needs energy. The energy is obtained from the breakdown of glycogen. According Suma'mur (2009), that fatigue is a decrease in endurance and body power to do the job.

In New Zealand between 2002 and 2004, driver fatigue was identified as a contributing factor in 134 fatal crashes and 1,703 injury crashes (approximately 11 per cent of fatal crashes and 6 per cent of injury crashes each year). The National Transportation Safety Board, driver fatigue in the United States considered to bet he most important road safety factor because accounts for approximately 100.000 heavy vehicle accidents and 1.500 fatalities per year. Fatigue is a factor in an estimated 30 to 40 percent of heavy vehicle accidents and 15 percent of fatal. Fatigue causes a loss of alertness in a driver. Which is slower reaction time, decreased skill levels, a driver's ability to concentrate and make critical decisions is reduced, it takes longer to interpret and understand a traffic situation. It is a significant problem in the road transport sector in terms of the health and quality of life of drivers, as well as in the potential for accidents [1].

In Indonesia traffic accidents are the number 3 killer after heart disease and stroke. According to Central Bureau of Statistics data in 2013 the number of traffic accidents amounted to 104,976 and the death toll of 23,385 people, meanwhile there are 93.52% factors causing the accident, that is due to driver error or human error. Drivers' factors are physical conditions such as fatigue, drowsiness, drunkenness, speeding, and misreading road directions [2].

The transport sector in many countries should be more concerned about the qualitative and quantitative aspects of working time. Excessive and irregular hours, poor working periods, high levels of stress, long waiting periods and

inappropriate training can lead to drivers fatigue and human error. The resulting economic and social consequences are reduced productivity, higher accident and occupational disease rates, absenteeism, higher turnover of staff, and increased workers' compensation rates, vehicle insurance and liability rates.

Work fatigue is not immediately addressed and immediately rest, then there will be accumulation of fatigue in a day, so it can have more severe impact on health. According Tarwaka (2010), the risk of working fatigue is: work motivation decreases, low performance, low quality of work, many mistakes, low work productivity, job stress, occupational diseases, injuries, and work accidents. According Setyawati (2010), that the impact of job fatigue is decreased job performance, body feels bad, work morale decreases, and decreases work productivity.

In the Grogol terminal there are various mass public transports such as buses, public transport WBK (Wahana Bina Karya), as well as urban transport with various routes. One of the public transports contained in the Grogol terminal is a bus. Buses are any motor vehicle equipped with seating for more than eight persons, excluding seating for drivers, whether equipped or not equipped with luggage. The bus located at the Grogol terminal is an APTB bus (Integrated Border Transmission Busway) serving the border areas of Jakarta (Bogor, Depok, Tangerang and Bekasi). APTB bus at Grogol terminal has a long distance and traffic condition through which APTB buses tend to be crowded and even jammed for hours, it becomes one of the reason the researcher chose the research place at Grogol terminal. Transjakarta bus located at Perum DAMRI SBU Transjakarta busway corridor 8 serves the Jakarta community with Terminal Lebak Bulus - Harmoni Sentral route. Transjakarta bus corridor 8 has a distance of 26 km. The distance is shorter than the APTB bus route distance.

2. METHODS

This research use a quantitative research, with cross sectional study design. In this research data collection technique that writer use is saturated samples

where The population of this study were 30 respondents APTB bus drivers and 40 respondents from Corridor 8 Transjakarta bus drivers. The sampling method were using saturated samples with 70 respondents. Analysis of this research data using univariate and bivariate analysis using chi-square test and calculated Odds Ratio (OR).

3. RESULTS

Data respondent characteristic includes age, gender, length of experience, nutritional status from the interview on APTB bus driver and Transjakarta bus coridor 8 use quesioner. Data of work fatigue was obtained from subjective self rating test on APTB bus driver and Transjakarta bus corridor 8 using IFRC (Industrial Fatigue Research Committee) questionnaire which is a questionnaire that can to measure subjective fatigue level by yielding score. The following is the average distribution of work fatigue on APTB bus drivers and Transjakarta bus corridor 8.

Table 1. Frequency Distribution Characteristics Age, sex, length of experience, and nutritional status of APTB bus drivers and Transjakarta bus Corridor 8

Respondent Characteristic	Bus Driver				Amount	Percentage%
	APTB		Transjakarta			
	n	%	n	%		
Age : ≥ 36 year	14	46,7%	22	55%	36	51,4 %
< 36 year	16	53,3%	18	45%	34	48,6 %
Gender :Man	30	100%	38	95%	68	97,1%
Female	0	0%	2	5%	2	2,9%
Lenght of experience ≥ 5 year	17	56,7%	21	52,5%	38	54,3%
< 5 year	13	43,3%	19	47,5%	32	45,7%
Nutritional status						
Abnormal : <18,5 and ≥25	6	20%	5	12,5%	11	15,7%
Normal : 18,5 – 24,9	24	80%	35	87,5%	59	84,3%

Based on table 1 it shows that the number of drivers with the age category (≥ 36 years) as many as 36 drivers (51.4%), consisting of 14 bus drivers APTB and 22 Transjakarta bus driver corridor 8. Number of drivers by type category male

gender of 68 drivers (97.1%), consisting of 30 bus drivers APTB and 38 Transjakarta bus driver corridor 8. While the driver with the gender category of women as much as 2 people (2.9%) from the driver of Transjakarta bus corridor 8. Number of drivers with long service categories (≥ 5 years) of 38 drivers (54.3%), consisting of 17 APTB bus drivers and 21 Transjakarta bus driver corridors 8. number of drivers with normal nutritional status category as many as 59 drivers (84.3%), consisting of 24 APTB bus drivers and 35 Transjakarta bus driver corridor 8.

Table 2. Average Distribution of Work Fatigue on APTB Bus Driver and Transjakarta Bus Corridor 8

Work Fatigue	SD	Mean	Min	Max
APTB bus drivers	9,428	64,50	43	86
Transjakarta bus corridor 8	9,961	46,25	34	87

Based on table 2 it shows that the average fatigue of APTB bus driver working is 64,50 with standard deviation 9,428 and mean of work fatigue of Transjakarta bus driver equal to 46,25 with standard deviation of 9,961. The lowest score on APTB bus driver is 43 and the driver of Transjakarta bus corridor 8 is 34. And for the highest value in APTB bus driver is 86 and the driver of Transjakarta bus corridor 8 is 87.

The statistical test used to determine the difference between the average fatigue rate between APTB bus driver and Transjakarta bus corridor 8 is independent t-test. The independent t-test statistic test results the average fatigue difference between APTB bus driver and Transjakarta bus corridor 8 as follows:

Table 3. Independent T-test Results Differences Average Work Fatigue on APTB Bus Driver and Transjakarta Bus Corridor 8

Work Fatigue	Amount	*Mean*	SD	p-value
APTB bus drivers	30	64,50	9,428	0,000
Transjakarta bus coridor 8	40	46,25	9,961	

Based on Table 3 it shows that the average score of job fatigue score on APTB bus driver is higher than the average working fatigue on Transjakarta bus driver corridor 8. And from the result of independent T-test statistic test it can be concluded that there is a significant difference between average fatigue on APTB bus driver and Transjakarta bus corridor 8 (p-value = 0,000).

4. DISCUSSIONS

The results of this study indicate that there is a significant difference between the average of work fatigue on APTB bus drivers and Transjakarta bus driver corridor 8. This is in line with the research conducted by Khakima (2011), that there is a difference in labor fatigue before and after exposure to heat in Metal Casting Industry Nedya Aluminum Klaten. Similarly, with Rochmah (2011) study, that there is a difference in work fatigue before and after exposure to heat stress on labor. As well as research conducted by Umyati, et., Al (2015) there is a difference in work fatigue on Arimbi bus drivers.

Work fatigue will decrease performance, decrease work capacity and work resilience characterized by tired sensation, decreased motivation, decreased activity. The characteristics of work fatigue will increase with the length of work performed, while the decreasing fatigue can increase work errors will provide opportunities for industrial injuries [10].

Driver fatigue results in performance alertly, extension of reaction time, memory problems, coordination delays, loss of information processes and also leads to a decrease in motivation. Motivation to perform a task decreases, communication and surrounding interactions also decline. Fatigue affects decreased ability and work motivation, it also happens in driving work. This fatigue has a specific impact on the behavior of drivers (driving behavior) [3]. Driver fatigue may also manifest in drowsiness and decreased attention resulting in loss of vigilance that may result in traffic accidents [8].

It is possible that the difference between the average of work fatigue between APTB bus driver and Transjakarta bus corridor 8, where the average

fatigue of APTB bus driver working is higher than the working fatigue of Transjakarta bus driver is caused by APTB bus distance (62 km) more far compared to Transjakarta buses (26 km). With longer mileage APTB bus drivers experience more work fatigue.

While working on long-distance buses, APTB bus drivers are required to continue to concentrate while driving for preparedness and full alertness to avoid unwanted events. According to Suma'mur (2009), working with concentration and high accuracy will require heavy brain performance thus increasing the risk of fatigue. Longer APTB bus mileage compared to Transjakarta bus corridor 8, APTB bus driver enables higher fatigue. Much distance requires having high concentrations and a monotonous work will speed up the occurrence of fatigue. Efforts that can be done to prevent the occurrence of fatigue is at the time of rest (eating or waiting for passengers) do relaxation by moving the hands, feet, head or shoulders to feel more relaxed body and not stiff or muscle pain. Relaxation can also be done by Transjakarta bus drivers due to the monotonous work (sitting driving).

The APTB bus driver only has one working shift per day (starting from 05.00 - 22.00) with a working time of 17 hours / day (including rest period) where 2 working days and 1 day off . While the driver of Transjakarta bus corridor 8 has two work shifts (05.00 - 13.00 and 14.00 - 22.00) with each working time duration 8 hours / day (including rest period) where 5 working days and 2 days off. This is another possible occurrence of the difference between the average fatigue work between APTB bus drivers and Transjakarta bus corridor 8.

APTB bus drivers in one day only have one shift of work with a duration of 17 hours / day (including rest period) with 2 working days and 1 day off if accumulated then in one week APTB bus driver work for 85 hours. This is not in accordance with Law Number 13 of 2003 concerning Manpower, where maximum working time is 8 working hours in 1 day or 40 working hours in 1 week and the rest for rest / life in family and community. Prolong working time

beyond that will only decrease work efficiency, increase work fatigue, accidents and occupational diseases [10].

While the driver of Transjakarta bus corridor 8 has work shift and working time in accordance with the Law No. 13 of 2013 on Manpower. The terminology in question is shift work is 24 hours work divided by rotation in 2 hours time. The workers are divided into working groups and are generally divided into three groups where the shift is eight hours (Nasution, 1989).

Efforts that can be made to reduce or eliminate fatigue are to pay attention to the general circumstances in the workplace environment such as the arrangement of working hours, resting arrangements, providing a place or room to rest, doing recreation and so forth [7]. Working hours arrangement is required for APTB bus driver to be adjusted to Law Number 13 Year 2003. Working hours arrangement by dividing in one day ie two work shifts so there is change of driver in every work shift (different driver). With the division of two working shifts in a day and the change of driver in every work shift is expected to work fatigue can be reduced and even eliminated.

5. CONCLUSION

Work fatigue will decrease performance, decrease work capacity and work resilience characterized by tired sensation, decreased motivation, decreased activity. Average fatigue on APTB bus driver is higher (64.50) than Transjakarta bus driver corridor 8 (45,25). There is a difference in average fatigue work between APTB bus drivers and Transjakarta bus corridors 8 years 2017. The conclusion for APTB and Transjakarta bus drivers is expected to be able to relax while waiting for passengers or rest and for APTB bus drivers it is necessary to set the working hours in one day by dividing the two work shifts.

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THE ANALYSIS ON CONFORMITY OF EMERGENCY RESPONSE SYSTEM BASED ON 2016 EDITION OF NFPA 1600 AT HIGHER EDUCATION

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Abstract

Emergency condition / disaster can be occur anywhere and at anytime including at college. This study is conducted in order to assess the conformity of the emergency response system at college. Which has reference to NFPA 1600 2016 edition. This study is qualitative study with descriptive analytic design. The result of this study is obtained from semi-structured interview, review of related documents, and observation of research location. From all six elements in NFPA 1600 2016 edition that has been assessed, total average of “Conforming” Category is 84.8 % , “Non-conforming” and “Not-applicable” is 8 % and 7.2 %

Keywords : Emergency Response System, College, NFPA 1600 2016 Edition

1. INTRODUCTION

Natural empiric condition in Indonesia shows that disaster could happen anywhere, anytime, and to anyone in various forms and levels. Thus, an emergency response system for prevention, mitigation, and solution against the possibility of disaster that would happen in workplace is needed. Law number 1 of 1970 on Occupational Safety explains that a workplace is a place where there is at least a worker who is working either on the land, in the water, or in the air, that is in the territory of jurisdiction in Republic of Indonesia[1]. In this case, it could be said that higher education is one of workplaces that is governed by Law number 1 of 1970. Higher education is a part of national education system that have strategic role in the intellectual life of the nation and to advance science and technology[2]. Higher education that is intended in this research is education that is in the university scope.

In dealing with fire hazard, a disaster emergency response team should be formed. Nowadays, the highest standard that can be applied generally according to disaster emergency response is NFPA 1600 which covers six elements which are Management Program, Planning, Implementation, Training and Education, Exercise and Tests, and Program Maintenance and Improvement[3]. The purpose of applying emergency response management is to protect assets in the form of buildings, workers, and facilitations. Thus, NFPA 1600 is a standard that is recommended in applying disaster emergency response, because it includes mitigation, prevention, preparation, response, and recovery[4].

Fire cases happened at higher education institution, especially university, in Indonesia has happened quite often, for example is the fire occurred in Bogor Agricultural Institution (IPB), in the faculty of agricultural engineering to be exact in March 2017, which caused Rp 2,000,000,000 (two billion rupiahs) at lost. Fire also occurred in University of Indonesia (UI), at the C tower of the faculty of social and political science in 2014, there were no victims on this case, only material lost caused by the fire[6]. These incidents could cause an emergency situation. An emergency situation would result in health, life, property, and environment risks. Thus, universities should make strategies for dealing with emergency situation.

This study was conducted in a university in a region in West Java. This university has had a K3L committee and emergency response team, with rules of emergency response referring to NFPA 1600 of 2016 standard. The university's decision on making emergency response management is based on cases happened to other universities in Indonesia. This university hopes that the making of emergency

response management in responding emergency situation could prevent, handle, and give response fast when the emergency situation occurred. On the other hand, it is aimed to minimize the lost that would happen, either material or human life, if the disaster occurs[8].

1. Literature Review

2.1 Emergency Response Preparedness

The terms Emergency Response Preparedness or abbreviated as ERP refers to the readiness/preparedness/precautions (Preparedness) and response/emergency response (Response) to a state of emergency (Emergency). This includes all activities required in preparing human resources and organization to carry out activities in an emergency or disaster situation. The activities include the formulation of emergency plan and procedures, ranging from supporting tools and resources that aim to save lives and minimize property damage[5].

2.2 2016 Edition of National Fire Protection Association 1600

NFPA or the National Fire Prevention Association 1600 is a standard that provides instructions to build, run, and evaluate disaster/emergency management and business continuity programs. To support the emergency management standards, NFPA uses six elements including Program Management, Planning, Implementation, Training and Education, Exercises and Tests, and Program Maintenance and Improvement [5].

Program Management Element is applied to identify what components are needed in program planning and implementation, while the Planning Element is used to discuss the actions to be taken to protect the public that have access and functional needs, property, operation, and environment. Further, the Implementation Element contains the implementation of emergency response measures undertaken by the entity. The Training and Education Element includes standards to ensure that all human resources have the skills and ability to deal with the danger risks while the Exercises and Tests Element is performed to show the expectations of the targets set by the entity. Finally, the Program Improvement and Maintenance Element is the element that is applied to review of emergency response measures to be maintained and enhanced in the future[5].

2. METHODS

This study is a qualitative study by interview, field observation, and review of related documents from June-August 2017. The result of this study is obtained from the analysis of primary data and

secondary data. Those data were obtained through interview method to relevant informants, such as head of the university's K3L committee and university's emergency response team. The questions of the interview were semi-structured according to the conditions that have been made by NFPA 1600, a standard which becomes a reference to university's emergency response laws.

The university has given the authorization in reviewing related documents that is needed according NFPA 1600 standard. Field observation was obtained, according to the fact on field. Some of the pictures were adapted from the university documentation.

3. RESULTS

The analysis result on conformity of emergency response system based on six elements of NFPA 1600 of 2016 at higher education is shown in Table 1. The result of the review of the analysis on conformity of emergency response system at higher education can be seen in Figure 1. And the average percentage result of the analysis on conformity of emergency response system at higher education based on NFPA 1600 of 2016 can be seen in Figure 2.

Figure 1. The Analysis Result of Conformity Based On NFPA 1600 2016 edition

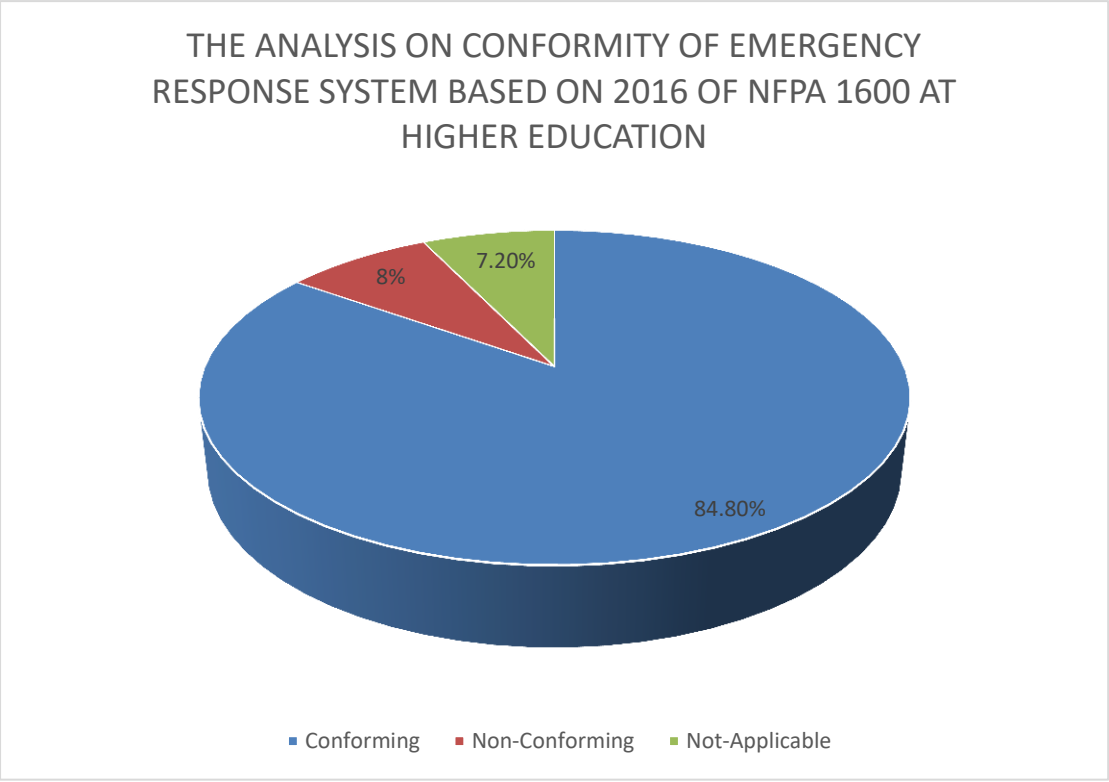

Figure 2. Total Average value of conformity based on NFPA 1600 2016 edition

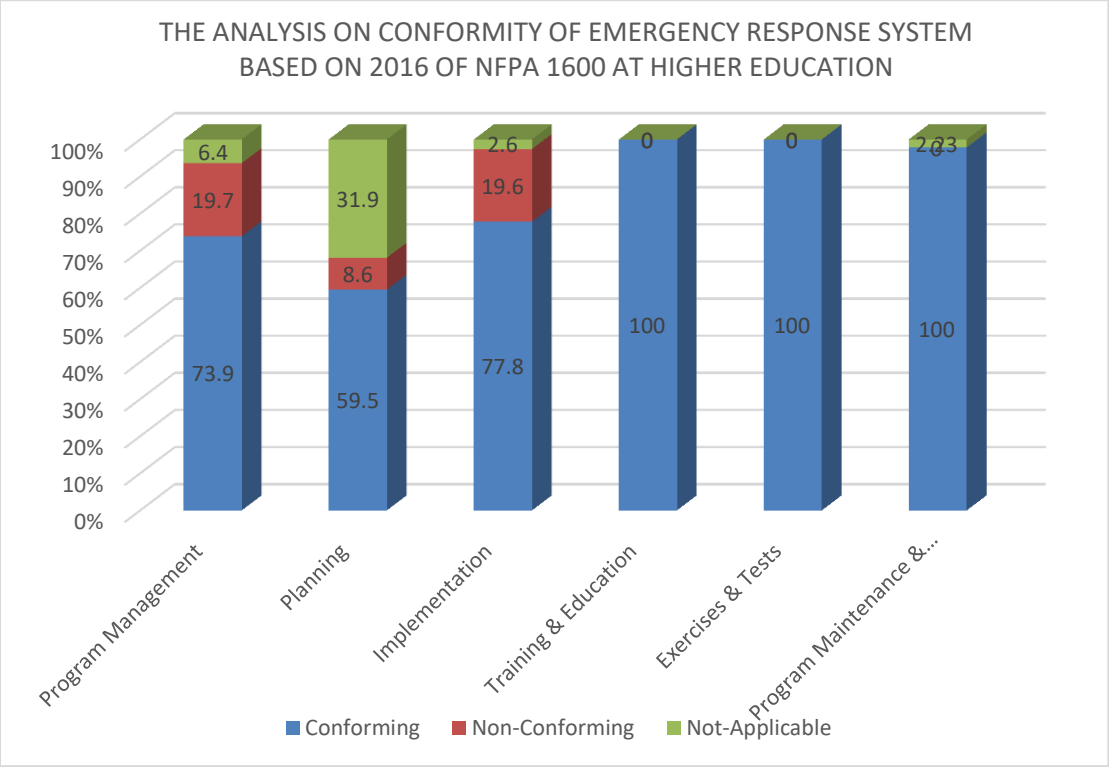

Table 1. THE ANALYSIS ON CONFORMITY OF EMERGENCY RESPONSE SYSTEM BASED ON 2016 EDITION OF NFPA 1600 AT HIGHER EDUCATION

NFPA 1600 ELEMENT PROGRAM	C	NC	N/A
1. PROGRAM MANAGEMENT			
Leadership and commitment	***100%***	***0%***	***0%***
Program Coordinator	***100%***	***0%***	***0%***
Program Comittee	***0%***	***100%***	***0%***
Program Administration	***82%***	***9%***	***9%***
Laws and Authorities	***100%***	***0%***	***0%***
Finance and Administration	***35.7%***	***28.6%***	***35.7%***
Record Management	***100%***	***0%***	***0%***
TOTAL AVERAGE	***73.9%***	***19.7%***	***6.4%***
2. *PLANNING*			

Planning and Design Process	***66.67%***	***33.33%***	***0%***
Risk Assestment	***30.6%***	***9.7%***	***59.7%***
Business Impact and Anlysis	***0%***	***0%***	***100%***
Resource Needs Assestment	***100%***	***0%***	***0%***
Performance Objectives	***100%***	***0%***	***0%***
TOTAL AVERAGE	***59.5%***	***8.6%***	***31.9%***
3. IMPLEMENTATION			
Common Plan Requirements	***100%***	***0%***	***0%***
Prevention	***50%***	***50%***	***0%***
Mitigation	***66.7%***	***33.3.%***	***0%***
Crisis Communication and Public Information	***100%***	***0%***	***0%***
Warning, Notification, and Communications	***100%***	***0%***	***0%***
Operational Procedure	***100%***	***0%***	***0%***
Incident Management	***56.25%***	***25%***	***18.75%***
Emergency Operations / Response Plan	***87.5%***	***12.5%***	***0%***
Busines Continuity and Recovery	***55%***	***38%***	***7%***
Employee Assistant and Support	***62.5%***	***37.5%***	***0%***
TOTAL AVERAGE	***77.8%***	***19.6%***	***2.6%***
4. ***TRAINING and EDUCATION***			
Curriculum	***100%***	***0%***	***0%***
Goal of Curriculum	***100%***	***0%***	***0%***
Scope and Frequency of Instruction	***100%***	***0%***	***0%***
Incident Management System Training	***100%***	***0%***	***0%***
Record Keeping	***100%***	***0%***	***0%***
Regulatory and Program Requirements	***100%***	***0%***	***0%***
Public Education	***100%***	***0%***	***0%***
TOTAL AVERAGE	***100%***	***0%***	***0%***
5. ***EXERCISES and TESTS***			
Program Evaluation	***100%***	***0%***	***0%***
Excercises and Methodology	***100%***	***0%***	***0%***
Design of Exercise and Tests	***100%***	***0%***	***0%***
Exercise and Test Evaluation	***100%***	***0%***	***0%***
Frequency	***100%***	***0%***	***0%***
TOTAL AVERAGE	***100%***	***0%***	***0%***
6. ***PROGRAM MAINTENANCE and IMPROVEMENT***			
Program Review	***93.33%***	***0%***	***6.67%***
Corrective Action	***100%***	***0%***	***0%***
Continuous Improvement	***100%***	***0%***	***0%***
TOTAL AVERAGE	***97.77%***	***0%***	***2.23%***

The element which belongs to the “Conform (C)” category is the one who has program and documentation and has already been run, whereas the “Not Conform (NC)” category belongs to the element who has program, yet does not have documentation or the program has not been conducted, and the “Not Applicable (N/A)” category belongs to the element who has no program and documentation.

4. DISCUSSION

Program Management

In the management program element in NFPA 1600 of 2016, there are seven variables, which are Leadership and Commitment, Program Coordinator, Program Committee, Program Administration, Law and Authority, Finance and Administration, and Record Management. The total average of the university conformity of this element is 73.9%, whereas the total average of the university incompatibility towards this element is 19.7%.

The University has undertaken a commitment established by the university rector, which contains that every faculty should establish a safety, healthy work and environmental system. Furthermore, the faculty also made an emergency response system based on NFPA 1600.

Planning

Planning element in NFPA 1600 has five variables, which are Planning and Design Process, Risk Assessment, Business Impact Analysis, Resource Need Assessment, and Performance Objectives. As for the total average of the university conformity towards this element is 59.5%, whereas the total average of the university incompatibility is 8.6%.

Once the observation has done, there are few findings such as the university has conduct risk assessment of the existing hazards in the environment, yet the university has not done risk assessment and business impact analysis. Those things are not fit with the element recommended by NFPA 1600. Risk assessment and business impact analysis is very important for the university in making decision in every phase of the emergency response management[7].

Besides, the university has made future planning in making prevention, preparation, recovery reaction and strategy.

Implementation

The third element of NFPA 1600 has ten variables including Common Planning Requirements; Prevention; Mitigation; Crisis Communication and Public Information; Warnings, Notifications, and Communication; Operational Procedures; Incident Management, Emergency Response Operation/Plan; Business Continuity and Recovery; and Employee Assistance and Support. The percentage of the total average of conformity towards this element is 77% and 19.6% for the incompatibility towards implementation element.

The implementation element starts with the making of general planning to support all programs such as roles and responsibilities, authorities, and mitigation strategies towards the threatening incident based on the result of danger identification. The university communicates latest every event and issue related to the safety through a website that is accessible publicly. Certainly there is a set about how and who has the authorization to communicate the news related to the events happen in the university in a procedure. This time, the university does not have a crisis command centre, which is a university operations centre during emergency situation, but if there is an emergency situation, operation centre will be conducted in K3L committee office. In the future, the university will have crisis command centre because it was being built process at this time. Those things become the conditions in NFPA 1600 of 2016 standard.

Training and Education

Training and education element has seven variables, which are Curriculum, Goal of Curriculum, Scope and Frequency of Instruction, Incident Management System Training, Recordkeeping, Regulatory and Program Requirements, and Public Education. The total average of conformity towards this element is 100%.

The university makes a few training planning every year, such as Fire Fighting, Emergency Management, Advance Fire Fighting, Basic First Aid, Advance First Aid, Simulation, and Hazardous Material Responder. Those trainings are aimed to enhance the level of skills and capabilities of all personnel and have a good response to emergencies, especially personnel who are members of the emergency response team. All training results are stored in the form of official news and photos or videos as seen in the figures below (Figure 3, figure 4, figure 5).

Figure 3. In-Class Training

Figure 4. First Aid Training

Figure 5. Life Saving Training (CPR)

Exercises and Tests

Exercises and Tests Element has some variables including Program Evaluation, Exercise and Test Methodology, Design of Exercises and Tests, Exercise and Tests Evaluation, and Frequency. The percentage of total average of conformity towards this element is 100%.

The university has conducted every point in the exercises and tests element well. The university always evaluates the procedures, policies, work instructions, and incident reports. Besides, the university also made emergency response planning and scheduling in matrix. These trainings are adjusted with the roles and responsibilities every personnel of the emergency response team, all these training was well-documented as Photos and videos as seen in the figure below (Figure 6, figure 7, figure 8, figure 9).

Figure 6. Fire Emergency Drill

Figure 7. Fire Emergency Drill

Figure 8. Fire Fighting

Figure 9. First Aid Emergency Drill

Program Improvement and Maintenance

In the program improvement and maintenance element, there are three variables including Program Reviews, Corrective Action, and Continuous Improvement. The total average of the university conformity in this element is 97.77%, whereas the percentage of the university incompatibility towards this element is 0%. Those percentage values are very good because the university has applied the program according to the program improvement and maintenance element of NFPA 1600.

The university has conducted a review about the emergency response system by doing program policies, procedures, and capabilities evaluation using performance goals.

5. CONCLUSION

Emergency response system conformity based on NFPA 1600 of 2016 analysis that has been conducted in a university in West Java reached total average of conformity by 84.80%, accordant to NFPA 1600 of 2016, 8% shows not conform, and 7.20% are N/A (not applicable). This result is obtained

from direct assessment and interviews of members involved in the university's emergency response system.

The result shows that the percentage of conformity of the university emergency response system is sufficiently appropriate to implement an emergency response system based on NFPA 1600 of 2016 standard. The university is still going to improve the existing emergency response system by continuously evaluating all aspects of the emergency response system in the hope that the emergency response system can be used properly whenever needed.

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Yasin, Muhammad. Evaluasi Sistem Manajemen Tanggap Darurat Pada Operasi Lepas Pantai di Perusahaan Hulu Minyak dan Gas. Universitas Indonesia. Depok. 2015

ANALYSIS OF EDUCATION AND TRAINING – COMPETENCY BASED IMPLEMENTATION OF LIFT AND HAULING AIRCRAFT SPECIALISTS AT EDUCATION AND TRAINING CENTRE, MINISTRY OF MANPOWER

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Abstract

The high use of lift and hauling aircrafts in manufacturing and freight ports requires the increasing number of supervisions and guidances in their use. Based on the results of some case reports, a number of accidents in the field of lifting and hauling aircraft is still going on. The lack of competence of inspector in the field of lift and hauling aircrafts specialits and lack of supervision increase the problem of foster and transport plane. Improving the quality and quantity of occupational health and safety supervisors who specialized in lifeboat and haulage is a solution that is through competence-based training / Competence Based Training (CBT) according to Work Competency Standards (SKKNI) Supervisors of Manpower. The research was conducted by using descriptive and analytic design through primary data of observation and interview and secondary data from literature review and Ministry of Manpower's data and information. The number of of occupational health and safety supervisors who are expert in aircraft lift and haul is still very low ie 50 people when compared to the number of objects being supervised. The role of PAA specialist PAA experts outside the government agencies in the examination and testing implementation is more dominant than the role of occupational health and safety supervisor PAA specialist labor department. The implementation of the PAA specialist supervisory training program has not been implemented comprehensively based on the comprehensive competency-based training.

Keywords: CBT Training, Inspector of OHS, Lifting and Transport Equipment, Competency Standard (SKKNI), Training institution, Certification institution.

1. INTRODUCTION

Occupational health and safety issues in the field of lifting and transport plane are still facing a lot of problems, such as the coaching and monitoring program of lifting and transport plane has not been optimally implemented. It is caused by the coaching and monitoring programme among the occupational and safety supervisors has been developed comprehensively. Based on the curriculum of educational and training program for OHS supervisors who specialized in lifting and transport plane, the education and training materials still focus only on crane, yet it does not cover all the monitoring aspects of lifting and transport plane use. In addition, the number of OHS supervisors who have an expertise in lifting and transport plane is still not enough. The number of of lifting and transport plane supervisors is only 50 people but the number of lifting and transport planes that need to be supervised is 62.359 units.

The lifting and transport plane supervisors have responsibility to monitor the use of lifting and transport plane itself and to monitor the maintainance and check of lifting and transport plane themselves, including lifting equipments, transport tape, transport plane on the runway and above the surface, as well as real rail transport equipment.

The solution needed to solve the lifting and transport plane issues above is implementing the educational and training programmes comprehensively for all the supervisors in the Ministry of Manpower to be suited with the qualifications needed. The implementation of the educational and training program which appropriate with the Working Competency Standards (SKKNI) is very necessary for all the supervisors in the Ministry of Manpower. Therefore, the training program that conducted based on Competency Based Training (CBT) model is really needed as one of the solutions to give knowledge, skill and work attitude with proportional composition , hence the aim of the training program in developing professional and qualified labor inspector can be achieved

Competence-based education and training is the program that aim to give, gain, improve, and develop work competence, productivity, discipline, attitude, and work ethic at certain skill and skill level according to the level and qualification of position or occupation. According to Suhadi (2016) Competence Based Training (CBT) is a job training that focus on the control of work skills that include knowledge, skills and attitudes in accordance with established standards and requirements at work. The standard used is the National Standard (KKNI / SKKNI), International Standards and Special Standards.

This study aims to analyze the implementation of OHS supervisory (in the field of lifting and transport planes) training that has been running whether it is in accordance with the competence and SKKNI, as well as input for the development of lifting and transport planes supervisory training materials.

2. METHODS

This research is a descriptive research with qualitative method on how to develop education and training of supervisor of OHS specialist in Lift and Transport (PAA) with Competence Based Training (CBT) approach. This research is conducted through survey / observation and in-depth interviews to the stakeholders in the Pusdiklat Pegawai (Center of Education and Training for Employees, Ministry of Manpower) that is the officials of Esselon II, esselon III and esselon IV. To evaluate the results of the training, the interview is done to the teachers (widyaiswara) in the field of labor inspection and management widyaiswara. As the monitoring and evaluation materials of alumnaes, the interview is also conducted to the supervisors of OHS Specialist in lifting and transport planes as the output of the training implementation.

Secondary data collected include Execution and Activity Plan (Renlakgiat) Pusdiklat, Accountability Report of Government Institution Activities (LAKIP) Training Center of Ministry of Manpower in 2015 and 2016, Quarterly Report on the Implementation of Labor Inspection in accordance with Ministerial Decree Number 09 Year 2005 and Data Report on Education and Program Implementation Training Center Training Center 2016 and other related data.

The study was conducted at the Employment Ministry Employment and Education Center in Jakarta. The study was conducted from April to June 2017.

3. RESULTS AND DISCUSSION

Monitoring dan Evaluation

Identification of quality and quantity of OHS inspector in aircraft lift and haul can be done by monitoring and evaluation method to alumni of OHS supervisor in the field of training specialist of lift and transport aircraft. In-depth interviews were conducted by some spekears, namely:

- 4 employees of OHS supervisors in lifting and transport aircraft specialist DKI Jakarta

- 2 supervisors of OHS specialist in lifting and transport aircraft West Java
- 1 person supervisor of OHS specialist in lifting and transport aircraft East Java

Table 2 Number of Lifting and Transport Aircrafts compared to number of OHS supervisors in lifting and transport aircraft specialists

Source: OHS supervisors in lifting and transport aircraft specialists

Area	**Lifting and Trasnport Aircraft Specialists**	**Number (unit)**
DKI Jakarta	9 persons	1.166
West Java	7 persons	9.703
East Java	11 persons	24.471

In this research, we will find the number of lift and transport unit which is not comparable with the number of OHS supervisors in lifting and transport aircrafts in DKI Jakarta, West Java and East Java provinces.

As the evaluation of the participants of the labor inspector training program begins with the implementation of written examination to measure the achievement level of the participants' understanding, the knowledge, the skill of making the supervisory work plan, making inspection note, making the employment reporting analysis, making the deed of supervision, labor inspection, demonstrating the implementation of the first, periodic and special examination. The evaluation of attitudes that implemented by the Pusdiklat utilize the observation method and the assessment among participants.

Training Need Analysis (TNA)

In order to get an overview of the training that will be implemented then the training institutions conducted TNA activities to find the gaps / gaps of competence that must be improved for employees who perform a certain task or position. Based on the results of TNA activities, the training institution will produce a foundation for the preparation of training programs and as a guideline to develop the training program designs. The following is an excerption of interviews that conducted by the researcher to the resource persons: 1 (one) II Esselon, 2 (two) Esselon III and 3 (three) Esselon IV Officials and 3 Major Experts.

The results of collected data are then analyzed in outline, ie organizational analysis is the result of TNA macro and task analysis and personal analysis as micro TNA.

1. Organizational analysis aims to determine the goals, objectives and strategic plan of training institutions
2. Task analysis is to know the description of problems in the field through the findings based on the information from the field officers and local officials
3. Personal analysis is the observation of leadership or direct management to the performance of employees in the field.

Competency Standards Development

Development of OHS Supervisory in field and transport aircraft standards should be complied with SKKNI in the field of labor inspector in order to create a competence-based OHS supervisory training form (CBT) to develop hard competence / hard skills and soft competence / soft skills. Pusdiklat employees prefer soft competence / soft skills than hard competence / hard skills. The findings of the interview from all interviews, the respondents explanied that hard skill is easier than soft skill. And also they stated most of the work is determined by soft skill. Soft competence / soft skill depends on the value and culture of the organization.

Soft skill is a competency that is closely related to the ability in managing the work process, human relationships and building interaction with others, such as leadership, communication, interpersonal relationships. While hard skill is a type of competence that related to the functional or technical ability of a job, for example marketing research, financial analysis, manpower planning.

The improvement of competency in each organization generally required team work, hence each person will play a significant contribution to provide competence to build team work competencies. Therefore, we need a working group competency model that contains the individual competencies needed as well as indicators of achievement of the best performance. Assessment of the 3600 feed back method can be used to assess group competence gaps [1].

Organization Management Policy

The commitment of organization management / training institutions to run competency-based education and training is the key to achieve the success of the program. Head of Pusdikat as a leader has the authority to manage and run the organization policy. Leaders are authorized to determine a strategic plan for pusdiklat in the future. In the Strategic Plan of Pusdiklat Minister of Labour on 2015-2019, there are 3 (three) main objectives as below:

1. The realization of competent training graduates (knowledge, skill, Atitude)
2. The realization of improving the quality of service to the User
3. Increased capacity and accountability of the Ministry of Manpower Training Center's performance

Learning Material Plan

Learning materials are a major part in delivering the knowledge and skills process, consisting of curriculum / syllabus and modules. The curriculum is a set of plans and arrangements for the implementation of teaching and learning activities. According to Mulyasa, E (2002) Competency-based curriculum (KBK) is a curriculum concept that emphasizes the development of the ability to perform (competence) tasks with certain performance standards so that the results can be perceived by learners, in the form of retain a certain set of competencies.

Based on the analysis results, Pusdiklat Minister of Labour employees held a curriculum development program every year. These programs were conducted to accommodate changes in the field. Especially for both general labor inspectors and OHS specialists, Pusdiklat invites stake holders in the field of training such as National Administary Body and Technical Directorate of OHS to jointly develop the curriculum adapted to the development of the latest field of labor inspection.

Based on the reviews of the documents that related to the training curriculum every year there is a dynamics which means that the training materials will always adjust to the conditions and conditions in the field, the analysis also shows that the major changes are on regulations and policies in the field of employment, there is always a circular (SE) either from the Minister or Director General will serve as guidelines for the implementation of Labor Inspection in regions throughout Indonesia.

The Development of Learning Intervention

Based on the results of interviews with all respondents, it is known that curriculum, syllabus, module, training materials, learning method, training time and teaching assignment are all implemented by esselon III unit, such as Program and Pusdiklat Evaluation in coordination with Pusdiklat Organizer. Implementation of education and training designed in Pusdiklat generally in the classic form, except there are some basic trainings that utilize the pattern of e-learning, such as Basic Labour Training, which was started in 2015.

Training institutions provide freedom to the trainer (widyaiswara) in delivering the training materials, diverse methods already implemented by each teacher include lecture methods, discussion, role playing, case studies. Trainer can use different methods for each class according to the ability, background and characteristics of the training participants.

This learning method has an important role in the learning process, training participants will also more easily digest the material provided. Based on these reasons, the chosen methods by the instructor / trainer should pay attention to the characteristics of training participants. They can use different methods for each class according to the ability, background and characteristics of the training participants.

Professional Certfication

Profesionnal certification institute (LSP) are different from Pusdiklat institution. However, Pusdiklat could develop LSP include the assessment place center (TUK) in their area. Pusdiklat is preparing some supporting facilities and infrastructures to be suitable for the competency test take place and also preparing the assessor staffs. LSP is prepared by a work committee established by or with the support of related industry / profession associations. The composition of the working committee consists of a chairman with a secretary, assisted by several assesor. The task of the working committee is to prepare legal entities, organize organizations and personnel, seek support from industry and related institutions. The assessor could be from industries, professional associations, technical agencies and experts.

Assessor is an LSP certified person who also gain certificate from National Board for Professional Certification (BNSP) and has an understanding of assessment implementation procedures, and has attended training assesor proved with competent certificate as

assessor which issued by BNSP. The assessor's main job is to carry out an assessment of the participants. Therefore the assessor should understand all the forms or aids and all the assessment tools. In carrying out the assessment, the assessor does not work alone, since the assessor can only work under LSP assignments. Application for obtaining license is addressed to National Board for Professional Certification (BNSP). Based on the interview findings, the LSP in Pusdiklat Ministry of Labour will be established in 2018.

4. CONCLUSION

The number of supervisors in OHS specialists of Aircraft lift and haul is still very low if it is compared to the number of objects being supervised. The number of 50 specialist OHS supervisors is incapable of conducting guidance and supervision of the thousands of existing and increasing lifting and hauling aircraft. The role of lifting and hauling aircraft specialist and its experts outside government agencies in the examination and testing is more dominant than the role of OHS supervisors in lifting and hauling aircraft specialist labor department. The implementation of the specialist supervisory training program has not been implemented comprehensively based on the comprehensive competency-based training.

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An E-Cigarette Epidemic: Health and Safety Issues for Its User

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Abstract

Objective: Electronic cigarette, also known as "e-cigarette" or "vape" has become a trend nowadays. E-cigarette is an electronic tool that can stream flavor liquid, in the form of vapor into the body by using electricity of the battery. In some developed countries, the intensity of e-cigarette users has increased rapidly from year to year. In Indonesia, data about the amount of e-cigarette users still doesn't exist yet, although Indonesia had a large amount of smokers. There hasn't any scientific evidence due to the safety and health risk of e-cigarettes. But there are some safety and health issues on e-cigarettes user that appeared in some countries. It can be strengthened by the chemical composition and the battery heat of e-cigarettes. The purpose of this study is to evaluate some published reports and researches related to e-cigarettes safety and health risk on its user. **Methods:** This research used literature review on some scientific journals and data reports, both national and international. **Results:** Although there are some health and safety issues regarding an e-cigarette use, the data about e-cigarettes health and safety effects are still uncertain. Available evidence suggests that e-cigarettes have a lower toxic content and exposure compared to tobacco cigarettes, but still the effectiveness of e-cigarettes as a smoking cessation tools are inconclusive. **Conclusions:** Public health practitioners should be more careful because the use of e-cigarettes is now growing rapidly. Why? Although it can be used for smoking cessation tool and reduce the amount of smokers, a scientific data about health and safety effects for its users still not available yet. In the absence of further data on e-cigarettes health and safety effects, it is better for us to discuss and explore more about e-cigarette, especially for its long term use.

Keywords: e-cigarette, electronic cigarette, smoking cessation

1. INTRODUCTION

As time goes by, cigarette smoking behavior is not indiscriminately anymore. It happens in various ages in both man and woman. Even after most scientist, doctor, and health experts revealed the deadly side of cigarettes, most people around us still have cigarette smoking behavior. This behavior is hard to stop indeed. It has already become a lifestyle. Many researchers did their research to look for ways to stop it. One of the ways is electronic cigarette, or also known as “e-cigarette” or “vape”.

At first, e-cigarette was made as a smoking cessation tool. It helps people to quit their tobacco cigarettes smoking habit by replacing tobacco with an electronic tool. Nowadays, e-cigarette has become a trend just like tobacco cigarette. The image of a “less harmful” cigarette that sticks into e-cigarette makes people feel safe to try. Not only smokers who try to quit their tobacco cigarettes smoking habit but also non-smokers are starting to try e-cigarettes.

What is e-cigarette exactly? E-cigarette is an electronic tool that can stream flavor liquid, in the form of vapor into the body by using electricity of the battery. The flavor liquid itself contains flavorings and lots of chemical substances including nicotine, although not always. In this modern era, the number of e-cigarette brands reach out more than 460 brands with around 7700 flavors [1] in several form such as cigars, pens, or even a device with fillable tanks. The main components of most e-cigarettes consist a mouthpiece, a cartridge that holds the flavor liquid, a heating element or also called an atomizer and a battery as power source.

The number of e-cigarette users is fairly high these years. Based on a recently released data brief from National Center for Health Statistics (NCHS), 12.6% of adults in United States (U.S.) had ever tried an e-cigarette at least once. About 3.7% of adults in U.S. still used e-cigarettes on a regular basis. More than one-half among current cigarette smokers who had tried to quit their smoking habit had ever tried an e-cigarette and 20.3% of them currently an e-cigarette users [2].

In some developed countries, the intensity of e-cigarette users has increased from 2.3 million users in 2013 became 5.1 million users in 2015 [3]. Some of them were using e-cigarette as smoking cessation tool and it has proven successful. Right at the time, an e-cigarette epidemic also happening in most of developing countries. About 3.2% from total population of Malaysia were active using e-cigarettes, where 10% of them still below the

legal age [4]. In Indonesia, data about the amount of e-cigarette users still doesn't exist yet, although Indonesia had a large amount of smokers. Indonesian Basic Health Research on 2013 proclaimed there are 301.134 people from total 1.027.763 population are active smokers [5]. The large amount of Indonesian smokers brings out possibilities related to e-cigarette epidemic.

As we already know before, tobacco cigarette has a lot of health effects, not only for its smokers but also people who breathe in the smoke. What about e-cigarette? Is it healthy enough for its users and people around the users? However, some e-cigarettes still contain nicotine and another chemical substances, although less than tobacco cigarettes, which is a hazardous substance in certain doses for health.

One thing that cannot be separated from health issue is safety issue. What about e-cigarettes safety? Is it safety enough to use since its main components consist an atomizer and a battery that has probability to explode in some unusual conditions? Even there hasn't any scientific evidence due to safety risk of e-cigarettes, there are some case reports related to e-cigarette explosions appeared in some countries.

The purpose of this study is to evaluate some published reports and researches related to e-cigarette safety and health effects on its user. We did some review to determine if e-cigarette is health and safety enough to use as one of smoking cessation tools or the other way around. At the end, we want to ensure what acts we should do as public health practitioners regarding to this e-cigarettes epidemic.

2. METHODS

This research used literature review on some scientific journals, data reports, and case reports, both national and international. We used multiple electronic database using some keywords related to our research, such as "e-cigarette', "electronic cigarettes=", "e-cigarette and smoking cessation", "health effects of e-cigarettes", and "e-cigarettes safety".

3. RESULTS

Although there are some health and safety issues regarding an e-cigarette use, scientific data about e-cigarettes health and safety effects are still uncertain [6,7,8]. Available evidence suggests that e-cigarette has a lower toxic content and exposure compared to a tobacco cigarette, but in several conditions it can be more addictive than tobacco cigarette

and lead into serious health problems. That makes the effectiveness of e-cigarettes as a smoking cessation tools are inconclusive [9]. In terms of safety, some residual risk due to e-cigarettes use may be present, but this is probably negligible compared to devastating consequences of smoking tobacco cigarettes [10]. There are also several case reports showed that probability of e-cigarettes explosion does exist but it is not sufficient compared with the amount of e-cigarette users.

4. DISCUSSION

As we know, nicotine is one of chemical substances which is hazardous for health. Nicotine contained in e-cigarettes absorbs into users bloodstream when they inhale it via the mouthpiece. Nicotine can be a highly addictive substance. It can also harm brain development system that may affect health and mental health, not only for its users but also others around the users who breathe in the smokes of e-cigarette. In some cases, it can harm pregnant women by crossing the placenta and causing some consequences such us sudden death syndrome, auditory problems, and obesity [11].

Even the amount of nicotine in e-cigarette is not as much as in tobacco cigarette, we still have to pay attention. The image of “less harmful” e-cigarette often makes people think that it has no health effects for its users, so they don’t have any worry to use it continuously in an excessive dose. In fact, it still damage the user health and can lead into serious health problems.

Another hazardous chemical substances contained in some e-cigarettes is a formaldehyde. Extrapolating high voltage, an e-cigarette use vaping at a rate of 3 ml per day would inhale 14.4±3.3 mg of formaldehyde per day [12]. Formaldehyde is reported as a carcinogenic chemical on a large amount of use in a long-term condition. Meanwhile, the short terms effects of formaldehyde exposure can also occurs. When the level of formaldehyde exceeds 0.1 ppm in the air, some people who breathe in the air may experience symptoms such as watery eyes, coughing, wheezing, nausea, and skin irritation [13]. A different reaction may occur regarding to individuals sensitivity of formaldehyde.

In term of safety, some residual risks due to e-cigarettes use may be present, but this is probably negligible compared to devastating consequences of smoking tobacco cigarettes. Research shows that mostly there is literally no fire or combustion on its use [14]. There is a case report of a 30-year-old man who experienced partial thickness burns on his leg and

knee after the battery ignition of his e-cigarette. The injured man reported that he was not using the e-cigarette device at the time when the ignition happened. He put the device right at his pants before suddenly he heard a loud “explosion” noise. The main causes of this case is still unknown. As for possibility that may caused the ignition is e-cigarette lithium battery which easily get heated and pose a risk of fire and explosions [15].

After read up some research regarding health and safety effects of e-cigarettes, we realize that e-cigarette can be harmful sometimes, both for health and safety even the full scientific data is still not available yet. Now, public health practitioners and governments need to create regulations due to e-cigarettes sales limitation. Only a few countries had regulations about e-cigarettes. One of them is United States (U.S.) which imposes regulations to protect the health of Americans where minors can no longer buy e-cigarettes [16,17].

5. CONCLUSIONS

Public health practitioners should pay attention with this e-cigarette epidemic, especially with the amount of e-cigarette smokers which is growing rapidly nowadays. Why? Although e-cigarette is less harmful than tobacco cigarette and can be used to reduce the amount of smokers by being smoking cessation tool, the scientific data about health and safety effects for its users still not available yet. In the absence of further data on e-cigarette health and safety effects, we should be more careful and do something to prevent any health and safety risks of e-cigarette users which probably occur. Now, it’s better for us to discuss and explore more about e-cigarette, especially for its long term use.

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EFFECTIVENESS OF PT. SINGLURUS PRATAMA MINE SAFETY MANAGEMENT SYSTEM, KUTAI KARTANEGARA

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Abstract

The mining industry has grown and developed rapidly. The growing extent of operational activities means more risk, higher potential for danger and accidents. Risks can be prevented by implementing an effective and efficient mining management system. The crucial element to prevent the risk is the people that implement the system. PT. Singlurus Pratama is engaged in coal mining business that always obeys the regulations set by government in which its health and safety management is implemented based on Regulation of the Minister of Energy and Mineral Resources no. 38 of 2014 concerning mining safety management system. The organizations and personnel is system implementation prime mover that involved and make sure the system runs as expected. This study aims to determine the level of effectiveness of the implementation of the mining safety management system of PT. Singlurus Pratama which focuses on the element 3 - organizations and personnel. This research uses quantitative & qualitative methods (mixed method) support with observation and interview. There are 13 sub elements in element 3. Overall, the research output shows the effectiveness of element 3 is 88.46%, which categorize in good and effective category.

Keywords: Effectiveness, Management, Safety, Mining

1. INTRODUCTION

The mining industry has grown and developed rapidly, due to the increasing impact of consumption needs urging companies to improve the production process by, among others, exploiting and exploring areas considered potential for the industry. The growing extent of operational activities means higher potential for danger and accidents because of the numerous workers involved. However, these problems can be prevented by implementing an effective and efficient mining management system. The crucial element to prevent the risk is the people that implement the system. The organizations and personnel is system implementation prime mover that involved and make sure the system runs as expected. PT. Singlurus Pratama has implemented Regulation of the Minister of Energy and Mineral No. 38 of 2014 but is still in the stage of development and internal audit requiring various inputs and assessment with regard to the effectiveness of the implementation of the government regulation at PT. Singlurus Pratama. This study aims to determine the level of effectiveness of the implementation of the mining safety management system of PT. Singlurus Pratama which focuses on element 3 - organization and personnel.

LITERATURE REVIEW

Definition of Effectiveness

Work effectiveness is a state of achievement of the expected or desired goal through the completion of work in accordance with a predetermined plan. The definitions of effectiveness according to experts are, among others defines effectiveness as the utilization of resources, facilities and infrastructure in a certain amount consciously set before to produce a number of goods for services activities undertaken. Effectiveness demonstrates success in terms of whether or not the goal has been achieved. If the output of the activity is close to the target, it means the effectiveness is higher. If we see the effectiveness of work in an organization both private and government, the target is focused on the implementation process and the success rate of the activities undertaken by the employees. The activity in question is an effort that can provide the maximum benefits for the organization. The terms effective and efficient are terms that are interconnected and should always be borne in mind in an effort to achieve the goals of

an organization. In principle, the individual effectiveness of the personnel in carrying out the task is in accordance with their respective position and role within the organization. In relation to this, some experts have given the definition of effectiveness as follows: Umar (2013: 121) defines effectiveness as a hope that gives a picture of how far the target can be achieved. From the opinion of the expert above, it can be concluded that a job can be executed appropriately, effectively and efficiently if the work is carried out properly in accordance with the plan. It is clear that the actual effectiveness of work is the ability of one or several people, especially employees in one unit organization or company to implement the objectives achieved in a system determined by a view to meet the needs of the system. Based on the aforementioned opinions, it can be concluded that the effectiveness is the ability of a person or several people in a group or organization to actualize uses or benefits from an activity done.

Measurement of Effectiveness

The study of effectiveness is based on variables meaning it is a concept that has value variations, where they are measures of effectiveness. This is in line with the opinion of Sudarwan Danim in his book *Motivasi Kepemimpinan dan Efektifitas Kelompok (Leadership Motivation and Group Effectivenesss)* which mentions several variables that affect the effectiveness, namely:

1) Independent variable namely is the main variable that affects the dependent variable that is given in nature and form, as follows:
    a. Structure, related to size.
    b. Task, namely the task and level of difficulty.
    c. Environment, namely the physical state of the organization, workplace or other.
    d. Fulfillment of needs, namely the physical needs of the organization, needs at work and others.
2) Dependent variables, namely variables that can be affected or can be bound by other variables with the examples as follows:
    a. Speed and degree of misunderstanding.
    b. General results that can be achieved over a period of time.

3) Intermediate variable, namely a variable determined by an individual process or organization that also influences the effect of the independent variable.

In relation to the above, the matters that influence effectiveness are the size, level of difficulty, satisfaction, results and speed and individuals or organization in implementing an activity / program, followed by evaluation in case of misunderstanding on the level of productivity achieved, resulting in sustainability. The measure of effectiveness is a standard of fulfillment of the goals and objectives to be achieved and indicate the extent to which the organization, program / activities perform its functions optimally. Effectiveness should be a comparison between the input and output. The measure of effectiveness must be the level of satisfaction and creation of friendly working relation and high intensity, meaning the measure of effectiveness is a high level of the sense of belonging to each other.

The effectiveness is measure using the standard SMKP assessment level based on Regulation of the Minister of Energy and Mineral Resources no. 38/2014

Table 1. Measurement Level

Effectiveness Ratio	Achievement Level	Effectiveness Level
< 70%	In	Ineffective
70% - < 80%	Adequate	sufficiently effective
80% - < 90%	Good	Effective
$\geq$ 90%	Satisfy	Very Effective

Resources: Lampiran II Permen ESDM No.38/2014

Mineral and Coal Mining Safety Management System

Mineral and coal mining safety management system, hereinafter referred to as SMKP Minerba, is part of the overall corporate management system in the context of controlling mining safety risks comprising the safety and health of the mining operation and safe operation of mines. Mining safety is any activity that includes the safety and health management of mining and mining operations safety. Mining safety and health hereinafter referred to as Mining safety and health is all activities to ensure and protect miners' safety and health through the efforts of managing work safety, occupational health, work environment, and occupational safety and health management system. Mining operations safety, hereinafter referred to as mining

operations safety, are all activities to ensure and safeguard safe, efficient and productive mining operation through efforts such as system management and maintenance of mining facilities, infrastructure, installation and equipment, installation security, feasibility facilities, installation infrastructure, and mining equipment, competence of technical personnel, and evaluation of reports on the results of mining technical studies. (Source: Regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number 38 of 2014 concerning Implementation of Mineral and Coal Mining Safety Management System*)*

2. METHODS

The method used is quantitative & qualitative (combination method) with observation approach to analyze the effectiveness of SMKP Implementation at PT. Singlurus Pratama Samboja - Kutai Kartanegara, the results of the observations are then compared with SMKP No. 38 of 2014 with regard to element III - Organization and Personnel and is expected to produce a percentage.This research for final project lasted from March 2017 to May 2017 reviewing the process of implementation SMKP No. 38 of 2014. This research was conducted at PT. Singlurus Pratama having address at Jl. Soekarno Hatta Km 34 RT 12 No. 38, Kelurahan Karya Merdeka, Samboja - Kutai Kartanegara 75272, East Kalimantan.

3. RESULTS AND DISCUSSION

There is 13 sub element under the element III Organizational and personnel based on Regulation of the Minister of Energy and Mineral Resources no. 38/2014. All results from the sub element shown on table below.

Table 2. Result of SMKP effectiveness at PT. Singlurus Pratama

Sub Element Number	Sub Element Discussion	Percentage		SMKP assessment level Based on Regulation of the Minister of Energy and Mineral Resources no. 38/2014	Outcome Description
		Effective	Ineffective		
III.1.	Organizational structural arrangement and assignment, duty, responsibility and authority	100%	0%	Satisfy	Very Effective

Sub Element Number	Sub Element Discussion	Percentage		SMKP assessment level Based on Regulation of the Minister of Energy and Mineral Resources no. 38/2014	Outcome Description
		Effective	Ineffective		
III.2.	Mine technical chief, Head of Underground Mine, and / or Head of Dredgers for Mining Companies	100%	0%	Satisfy	Very Effective
III.3.	Operation Person In charge for Mining Services Company	100%	0%	Satisfy	Very Effective
III.4.	Process of Establishment and Stipulation of Mining HSE and Mining Operation Safety Department	100%	0%	Satisfy	Very Effective
III.5.	Appointment of Operations Supervising and Engineering Supervising	77%	23%	Adequate	sufficiently effective
III.6.	Appointment of Special Mining Engineering Personnel	100%	0%	Satisfy	Very Effective
III.7.	Process of Establishment and Determination of the Mining Safety Committee	93%	7%	Satisfy	Very Effective
III.8.	Appointment and Determination of the Emergency Response Team	80%	20%	Good	Effective
III.9.	Selection and Placement of Personnel	100%	0%	Satisfy	Very Effective
III.10.	Implementation of Education and Training and Work Competence	100%	0%	Satisfy	Very Effective
III.11.	Preparation, Stipulation, and Application of Mining Safety Communication	100%	0%	Satisfy	Very Effective
III.12.	Management of Mining Safety Administration	100%	0%	Satisfy	Very Effective
III.13.	Preparation, Implementation, and Documentation of Participation, Consultation, Motivation and Awareness Procedures Implementation of SMKP Minerba	0%	100%	Inadequate	Ineffective
Conclusion of Final Results		88.46%	11.54%	Good	Effective

Resources: Processed data, 2017

The result of the research on SMKP Element III Organization and Personnel, Point 1 on organizational structural arrangement and assignment, duty, responsibility and authority shows that the effectiveness of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by

the organizational structure created in accordance with the respective expertise of personnel - lastly revised in June 2017 disseminated to all employees in each department with a total number of 252 employees.

Point 2 on the appointment of Mine Technical Chief (KTT), Head of Underground Mine, and / or Head of Dredgers for Mining Companies subdivided into several points III.2.1. on KTT, III.2.2. on the Head of Underground and III.2.3. about Head of Dredgers shows that the effectiveness level of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the letter of appointment of KTT by MD on June 4, 2015 and letter of attestation by KAIT dated October 2, 2015, the KTT is positioned as the General Manager having POU competence. Underground mine and dredger do not apply to PT. Singlurus Pratama because they are not its expertise and does not affect the level of effectiveness.

Point 3 on the appointment of Operation Person In charge (PJO) for Mining Services Company shows that the level of effectiveness of the conformity of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the letter of appointment of PJO by KTT which has the competence of supervisor of operation, PJO is appointed when a new project / new contractor is obtained or when there is change of the Project Manager (5 June 2017).

Point 4 on the Process of Establishment and Stipulation of Mining HSE and Mining operations safety Department shows that the effectiveness of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the structure of the Mining HSE and Mining operations safety (lastly revised on April 1, 2017) involving 43 employees from all departments including the contractors, PJO from PT. PWP, PT. MIL, PT. SIPRIMA, PT. Bambu Mas., Existence of the mining rescue team formed in 2012 and trained in 2013 certified by BASARNAS, existence of monthly crash statistics prepared by the HSE team evaluated at the safety committee meeting as well as existence of engineering personnel competency data updated every year.

Point 5 on appointment of Operations Supervisor (PO) and Engineering Supervisor (PT) shows that the level of effectiveness of conformity of SMKP at PT. Singlurus Pratama is sufficiently effective (77%) evidenced by the letter of appointment of PO and PT by KTT refreshed at least once a year, PO performs inspection and audit every day but testing is done according to the agreement with the area person in charge. PT conducts inspections of

electrical & anti lightning distributor every 6 months survey equipment inspection is done every day. However, the preparation of report, investigation of infrastructure facilities for installation and mining equipment before use / after re-installation / repair and planning the maintenance schedule has not been performed properly because the signing should be done on a daily basis but in fact the signing is done monthly and there is no planning schedule for proper maintenance of mining installation and facilities.

Point 6 on Appointment of Special Mining Engineering Personnel, Certificate of Competence of Special Mining Engineering Personnel, and List of Special Mining Engineering Personnel shows that the effectiveness level of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the letter of appointment of special mining engineering personnel by KTT refreshed at least every 2 years, existence of list of 16 specialized mining engineering personnel people having mine test competence, hiperkes, radiation protection, ERT and navigation school.

Point 7 on Process of Establishment and Determination of the Mining Safety Committee shows that the effectiveness level of SMKP at PT. Singlurus Pratama is very effective (93%) evidenced by the establishment of the mining safety committee in 2010 lastly revised in March 2015 by KTT approved by MD with a total membership of 63 employees involving all departments, 4 to 5 representatives as well as the contractors. The mining safety audit is conducted every year internally, existence of planned monthly meetings of the mining committee lastly held in July 2017, the minutes of the mining safety committee meeting have been well documented and distributed by the secretary of the mining safety committee and are open for access. Members of the mining safety committee are also equipped with Basic Fire Fighting and Basic Training, First Aid & CPR, Job Safety Analysis, Mining Safety, Occupational Health. However, the reporting to KAIT has not been realized because it needs revision in the form of committee member reduction after employee downsizing in 2016.

Point 8 on Appointment and Determination of the Emergency Response Team (ERT) shows that the level of effectiveness of SMKP conformity at PT. Singlurus Pratama is effective (80%) as evidenced by the ERT organizational structure established by the HSE team as well as KTT revised for the third time on July 1, 2015 with 3 coordinators, 7 team leaders of ERT SGP members and contractors, 14 members at ERT office Km 34; 17 members at ERT site merdeka;

15 members at ERT site mutiara; and 12 members of ERT CCP mutiara equipped with SAR skills and competencies from BASARNAS and will be refreshed by the end of 2017. Preparedness exercises were held in January and February 2017. However, the ERT organizational structure reporting to KAIT has not been well realized due to revision in the form of reduction of the emergency team members after employee reduction in 2016.

Point 9 on Selection and Placement of Personnel shows that the effectiveness level of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the job description of each employee stated in the employment contract and detailed in SGP-IK form accounted for by the HRD Manager and Manager of the relevant department.

Point 10 on Implementation of Education and Training and Work Competence shows that the level of effectiveness of the conformity of SMKP at PT. Singlurus Pratama is very effective (100%) proved by the TNA (Training Need Analysis) conducted since 2015, existence of education and training programs in 2017 created in December 2016 approved by KAIT during the 2017 RKAB report on January 31, 2017, well documented activities evaluated once a year. Presence of teachers involving KTT, HSE Manager, safety officer and corporate doctor. Education and training for all miners is refreshed every 3 months. The subjects for open miners are HSE Regulations, HSE Fundamentals, HSE Inspection, HSE Accountability, Hazard-Risk, JSA, LOTO, Fire Fighting, First Aid, SMKP, and Management of mining environment, Duties & responsibilities of supervisors. POP is owned by Foreman up to Head Dept. Production, Supervisory Dept. MPE, Supervisor Dept. CCP, Supervisory Dept. Exploration and HSE. For POM owned by Manager Prod., Head Prod. Site MT, Chief Exploration, Senior Engineer and HSE Manager. POU is only owned by KTT. However, education and training of underground miners as well as PO and PT underground mines do not apply at PT. Singlurus Pratama because it does not engage in the field and does not affect the level of its effectiveness.

Point 11 on Preparation, Stipulation, and Application of Mining Safety Communication shows that the effectiveness level of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the existence of IK compilation, establishment and implementation of mining safety communication (SGP-IK-HSE010_Rev.00). The form of communication mechanism is the

general induction of KPLH for employees and company guests, Daily Meeting / P5M, Safety Talk, Weekly Meeting & HSE Committee and have been well documented and distributed.

Point 12 on Management of Mining Safety Administration shows that the effectiveness level of SMKP at PT. Singlurus Pratama is very effective (100%) evidenced by the existence of a mining book filled by KAIT, KTT and the person appointed by KTT kept in the KTT Room. The mining book can be read and studied by mine workers with supervision even though only a few workers are aware of this rule due to poor dissemination of the mining books. Every mine accident has been included in the list of mine accidents and accounted for by the KTT. There are regular reports that are always created at the beginning of every month and reported in quarterly and quarterly time intervals.

Point 13 on Preparation, Implementation, and Documentation of Participation, Consultation, Motivation and Awareness Procedures Implementation of SMKP Minerba shows that the level of effectiveness of conformity of SMKP at PT. Singlurus Pratama is ineffective – (0%) proved by the absence of complete procedures on participation, consultation, motivation, and awareness of SMKP Minerba implementation as PT. Singlurus Pratama is still in the process of establishing, implementing and improving its SMKP.

4. CONCLUSION

Below is the conclusion of the results of research on "Effectiveness of the Implementation of Mining Safety Management System at PT. Singlurus Pratama, Samboja - Kutai Kartanagara 2017". From the description of the research output and discussion in chapter 4 on the discussion on element III - Organization and Personnel based on Regulation of the Minister of Energy and Mineral Resources No. 38 of 2014 which discusses the level of effectiveness, it can be concluded that the implementation of SMKP No. 38 of 2014 at PT. Singlurus Pratama element III - Organization and Personnel containing 13 sub-elements is effective by 88.46% falling in the category of GOOD and EFFECTIVE.

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Critical Control Management in Indonesian Mining Industry

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Abstract

Mining activities are known to have many risks with potential adverse impacts to the health and safety of its workers. Data from 2010 to 2014 showed that there were 997 mining accidents in Indonesia, with 146 of those accidents were fatalities. The causes of these fatalities are mainly due to too many controls on unwanted events, unclear accountability, and poor control quality assurance. Improvement on managerial control over rare but potentially catastrophic events needs to be made to prevent these fatalities from recurring. One of the well-known methods that can be adopted is the International Council on Mining and Metals (ICMM) Critical Control Management (CCM) process. The purpose of this review is to identify the challenges and potential benefits of implementing CCM in Indonesia. The expected outcomes are an improvement in operational risk management, change in focus, and decreasing complexity in the overall health and safety system in Indonesia. These objectives could be achieved by reviewing the CCM process applied to mining industry including the use of specific bowtie risk assessment methodology and literature study on the current application of risk controls. From the review, it has become apparent that to prevent accidents, identification of critical risks needs to be supplemented by critical controls. Strong leadership is of the essence to be able to face the challenges, positively engage workers and make better safety system works in sustainable manner. Complementary, development of regulatory requirement for a critical control management approach may accelerate CCM implementation in Indonesia but above all, Companies should recognize that improving their safety system is a “good-business” and need to have it embedded as their core business value.

Keywords: Risk Management, Critical Control Management, Incident Investigation, Health and Safety Management System

1. INTRODUCTION

In 2014, Indonesia's Ministry of Energy and Mineral Resources (ESDM) introduced the Implementation of Mining Safety Management System regulation, better known as SMKP. One of the SMKP requirements is regarding risk management. Despite the recently implemented regulation – the regulation was only to become mandatory after one year of its issuance – it has helped improve the accident statistics. This was shown through reduction of number of fatalities in 2015, from 35 to 25 and lastly, in 2016, 15 fatalities were recorded [1].

The average type of accidents in Indonesia mining industry, from 2010 to 2014, based on ESDM data [1] is buried (30%), hit by moving object (16%), falls from height (15%) and being hit by falling objects (15%). These type of mining accidents are similarly consistent with what happened in other countries such as Australia, where four types of accidents namely vehicle collision, being hit by moving objects, falls from height and being hit by falling objects are contributing 71.7% to fatalities [2].

The 2013 International Council on Mining and Metals (ICMM) report [3] described that the main reasons for fatalities and other serious incidents continue to occur are due to lack of risk identification, controls are not in place, controls are not effectively implemented or maintained. Where in Indonesia, the ESDM data [1] showed the average percentage of accidents are due to not following procedures (23%), unsafe workplace (20%), lack of coordination (14%), unsafe position (13%) and inadequate SOP (9%).

Although there have not been any specific pieces of evidences that could correlate the implementation of the regulation effect to the decrease of the number of accidents, it is obvious that there are significant necessities for the industry to review, from risk aspects, better ways to manage the critical unwanted risks including its controls.

There are many works of literature and studies or research on controls or barriers

management in mining industry outside of Indonesia, however, there are only a few available in the country. This paper discusses the role of the International Council on Mining and Metals (ICMM) critical control management (CCM) approach to address the issue of material or critical unwanted events in the Indonesian mining industry by focusing on its associated critical controls.

2. METHODS

The paper begins with a review of literature on risk management and a case study of CCM implementation at one of mining companies in Indonesia and summarized the benefits and challenges that the industry is facing in implementing the approach. Outcomes from the literature review and case study are discussed in the results section.

2.1 Literature Review

Risk Assessment

Safety management is based on risk management and it requires hazard identification to calculate the risk and try to eliminate or mitigate it [4]. Andonov, in his book Quality I Is Safety II [4], mentioned that there is a clear difference between hazard and risk, therefore to explain risk, we should understand the hazard. He explained that a hazard is a situation with potential to produce harm, injury or damage, therefore to find risk, we need to find the frequency of the situation that happens and the severity of consequence. He also expresses that calculating risk is not a problem, regardless of the method. The problem, however, he explained, is to predict a scenario of how the risk will materialize which is where an event with bad consequences is produced. He continued by explaining that there are few methods which are very popular in finance and banking that deal with scenario analysis about how bad things happen in an operational level. In Indonesia, many companies use the qualitative risk assessment method to calculate risks. Despite there has not been any research that support the reasoning behind this, the condition is primarily the same as, for example, in Australia, where is according to Joy [5] it is due to:

- Lack of accurate, valid 'hard' data about the event likelihood
- There is a wealth of industry experience at the management, supervisory and operational levels that can suggest subjective consequence and event likelihood
- Most of the time objective of the risk assessment is to manage priority risks, an objective that does not require a quantitative research for an effective outcome.

No matter extensive the risk assessment is, unwanted events still occurred. Hollnagel [6] wrote that in Safety-I or Safety based on reactive approach, the concern in accident analysis and risk assessments is to be so thorough and exhaustive that nothing important is overlooked. This is why he said that the devil is in the detail. In the contrary, if we adopt Safety-II or Safety based on proactive approach, the devil is no longer in the detail but in the whole. He continued that the devil is, in fact, not where we look but where we fail to look. The Safety-II focus is on the things that go right, and the corresponding efforts are to increase the number of things that go right. Furthermore, Kjellen [7] said that risk analysis should provide a risk picture based on current and future situations. They added that the analysis should not be solely based on historical data because the future is not necessarily repetition of the past.

The risk management approach that is well accepted in many industries are using the following steps [5]:

1. Risk Identification – identifying the hazards and the situations that have the potential to cause harm or losses (sometimes called 'unwanted events')
2. Risk Analysis – analyzing the magnitude of risk that may arise from the unwanted events.
3. Risk Control – deciding on suitable measures to reduce or control unacceptable risk.
4. Implementing and maintaining control measures – implementing the controls and ensuring that they are effective.

Bow tie Method

There are plenty of risk assessment technique available for organizations to use. International Organization for Standardization [8] came up with 31 different risk assessment techniques, where each one has its own relative strength and weakness. Andonov [4] mentioned that his best proposal for quantifying hazards into risks is to use Bow Tie Methodology. He then elaborates that the Bow Tie methodology is a combination of Fault Tree Analysis and Event Tree Analysis and that the connecting point between the two is the Event. He also stressed that this Bow Tie methodology can be used not only for safety analysis purposes but also quality as well. He argued that the model can only be used for linear system, in fact, he said that Bow Tie Methodology goes deeply into the processes and can be used to describe all interference and interactions inside the system. The ICMM critical control management approach uses bow tie method in assessing material unwanted event.

Risk Control

Risk treatment is sometimes referred to as risk control and it includes the selection and implementation of actions to reduce risk likelihood and risk impact [9]. A significant amount of literature highlights that to reduce reoccurring incidents, an enhanced focus on improving risk controls is needed [2]. According to James Reason [10], each organizational accident has at least three common features which are hazards, failed defenses and losses, where out of the these, the most promising for effective prevention is the failed defenses (controls, barriers, safeguards, etc.).

Kellen [7] defined barriers as a set of system elements (human, technical, organizational) that as a whole provide a barrier function with the ability to intervene into the energy flow to change the intensity or direction of it. The US Department of Energy [11] defined barrier as anything used to control, prevent or impede energy flows. A common type of barriers, they added, include equipment, administrative procedures and processes, supervision/management, warning devices, knowledge and skills, and physical objects.

In safety system, barriers or controls are used to protect personnel and equipment

from hazards by preventing an event to occur and mitigate if it had already happened. Accident, according to Joy [5], could occur if these three conditions exist:

- lack of adequate barriers;
- an unwanted energy flow;
- a target (such a person or equipment) in the energy flow

Safety-critical systems are those systems whose failures could result in loss of life, significant property damage, or damage to the environment [12]. Thus, in order to prevent an accident that could cause fatalities, appropriate critical barriers or controls are to be properly assessed and implemented.

In determining the controls, the application of hierarchy of control - Level 1 elimination, Level 2 substitution, separation or engineering, and Level 3 administrative and personal protective equipment shall be used. The US Department of Energy [11] categorized barrier cost/reliability hierarchy into 1. Physical barriers – highest cost, 2. Administrative or management policy barriers – medium cost, 3. Personal knowledge or skill barriers – least of cost. James Reason [10], explained two major principles in keeping a balance between profit and safety, which are: ALARP principle – keeping your risks 'as low as reasonably possible' and ASSIB principle – 'And Still Stay in Business'. These two major principles would need to be always kept in mind when selecting controls.

In order to find the appropriate controls to prevent accidents, Kjellen [7] adapted Haddon's [13] 10 accident prevention strategies as ways to select safety measures. The strategies are as follows:

1. Prevent buildup of energy
2. Modify the quality of energy
3. Limit the amount of energy
4. Prevent uncontrolled release of energy
5. Modify rate and distribution of the energy
6. Separate, in time or space, the energy source and the vulnerable target
7. Separate the energy source and the target by physical barriers
8. Make the target more resistant to damage from the energy flow

9. Limit the development of loss (injury or damage)
10. Stabilize, repair and rehabilitate the object of damage

These processes of selecting the right controls are captured in the identifying controls and selecting critical controls steps of the nine CCM steps.

Risk Monitoring

There are, however, in some circumstances, where barriers may not be present or may fail to perform. This is called limitation of barriers, and in his book, Kjellen [7] provided with a figure that can be seen below:

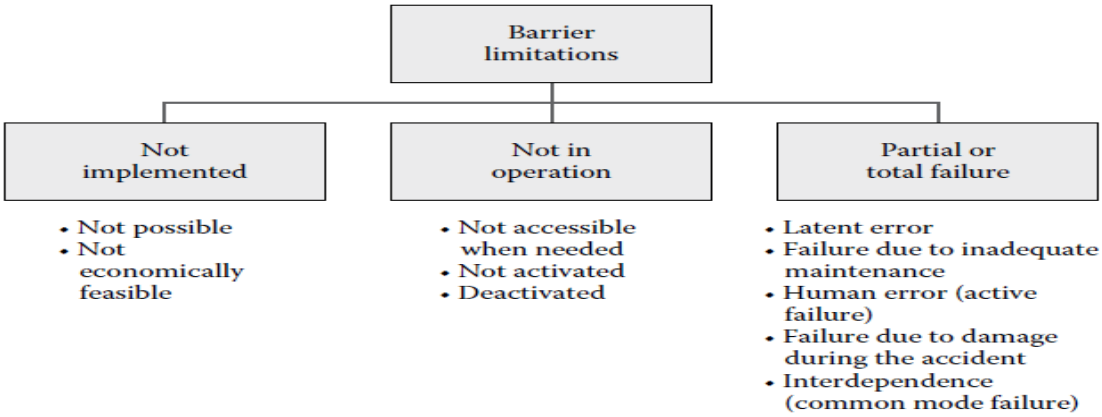

Figure 1. Limitation of Barriers (Adapted from Trost, W.A. and Nurtney, R.J., Barrier Analysis, Report No. SCIE-DOE-01-TRAC-29-95, Technical Research and Analysis Center, Idaho Falls, ID, 1995.)

In general, the figure above explained that barriers would be useless if 1. Not implemented, 2. Not in operation, and 3. There is partial or total failure. Therefore, it is important to perform monitoring and evaluation of controls.

The DoE [11] characterized criteria when evaluating the performance of barriers as follows:

- Effectiveness – how well it meets its intended purpose
- Availability – assurance the barrier will function when needed
- Assessment – how easy to determine whether barrier will work as intended
- Interpretation – extent to which the barrier depends on interpretation by humans to achieve its purpose.

The above literature explained about the importance of assigning accountability, ensuring the controls are implemented and that the controls are verified to ensure its effectiveness. These steps are also well captured in the CCM process as well as how the controls are communicated if they do not meet the defined criteria.

Critical Control Management Approach

The Critical Control Management Approach is an integral part of the risk management which focus on critical risks and associated critical controls. The process refers to the Health and Safety Critical Control Management: Good Practice Guidance and Critical Control Management Implementation Guidance from International Council Mining and Metals (ICMM) [14]. The guide provides advice on identifying critical controls, assessing their adequacy, assigning accountability for their implementation and verifying their effectiveness in practice.

The CCM process includes the use of Bow Tie analysis method for identifying and reviewing controls which are intended to prevent or mitigate a specific unwanted event. The unwanted event in the CCM focuses in what the ICMM called as Material Unwanted Event (MUE) where it referred to as an unwanted event with the potential or real consequence exceeds a threshold define by the organizations thus requiring the highest level of intention. The CCM itself is a process of managing the risk of MUEs that involves as systematic approach to ensure critical controls are in place and effective. The definition of the critical control, according to ICMM in this context is a control that is crucial to preventing the event or mitigating the consequences of the event. They added that the absence of the failure of a critical control would significantly increase the risk despite the existence of other controls. Also, a control that prevents more than one consequence is normally classified as critical.

The critical control management approach has nine steps process where each step has its own specific target outcome.

Table 1. ICMM Critical Control Management Steps and Target Outcomes

Step	Target Outcome
Planning the process	A plan that describes the scope of the project, including what needs to be done, by whom and the timescales.
Identify material unwanted event	Identify MUEs that need to be managed.
Identify controls	Identify controls for MUEs, both existing controls and possible new controls. Prepare a bowtie diagram.
Select the critical controls	Identify the critical controls for the MUE
Define performance and reporting	Define the critical controls' objectives, performance requirements and how performance is verified in practice.
Assign accountability	A list of the owners for each MUE, critical control and verification activity. A verification and reporting plan is required to verify and report on the health of each control.
Site Specific implementation	Defined MUE verification and reporting plans, and an implementation strategy based on site-specific requirements.
Verification and reporting	Implement verification activities and report on the process. Define and report on the status of each critical control.
Response to inadequate critical control performance	Critical control and MUE owners are aware of critical control performance. If critical controls are underperforming or following an incident, investigate and take action to improve performance or remove critical status from controls.

One of the important steps in the process is selecting critical controls. The CCM uses the critical control decision tree adapted from BHP Billiton as shown in figure 2 below:

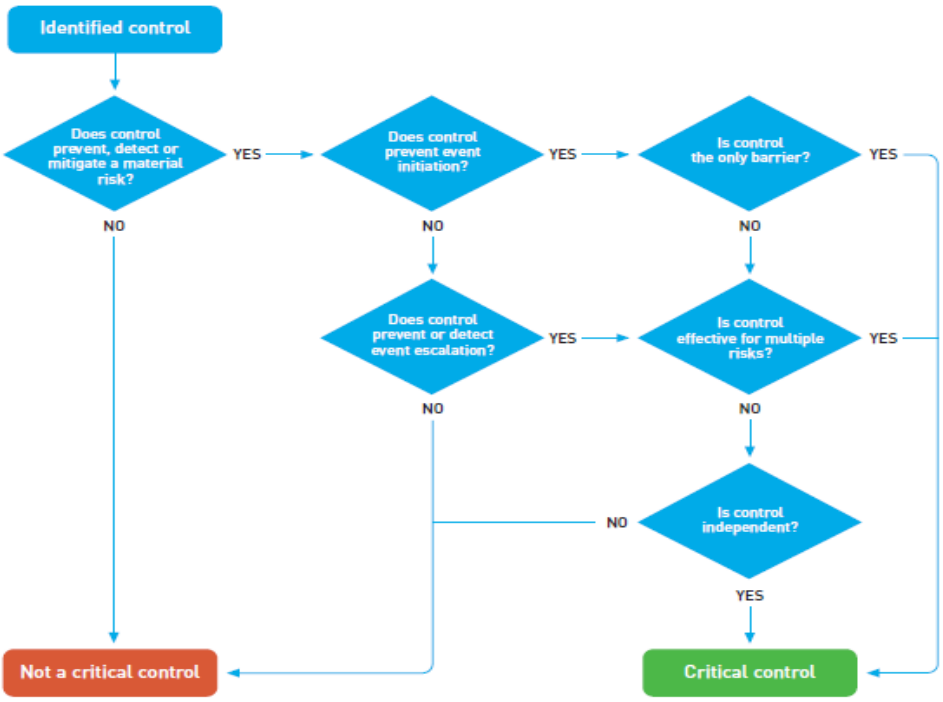

Figure 2. BHP Billiton critical control decision tree

2.2 Case Study

Application of Critical Control Management

To illustrate the practical application of critical control management approach, the authors provide an example of the CCM implementation in a medium sized mining company in Indonesia, referred here as PT X. The Company, as stated in its HSE policy, is committed to putting safety as the first priority in doing business.

The company has a safety management system that is in compliance with SMKP based system. It has already baseline risk assessment of its activities. From the risk assessment, there were 15 safety risks that are identified as critical risks. The critical risk is defined as the risk with potential impacts of multiple fatalities.

For those 15 critical risks, the company conducts second risk analysis using the Bow Tie methodology. This is to provide better understanding of the risk potential causes and impacts, existing preventive and mitigating controls and the improvement

tasks.

In this particular case, the event title that the authors took as an example is the vehicle interaction. Being the most apparent risk in mining activities, the example would allow easy understanding of the process.

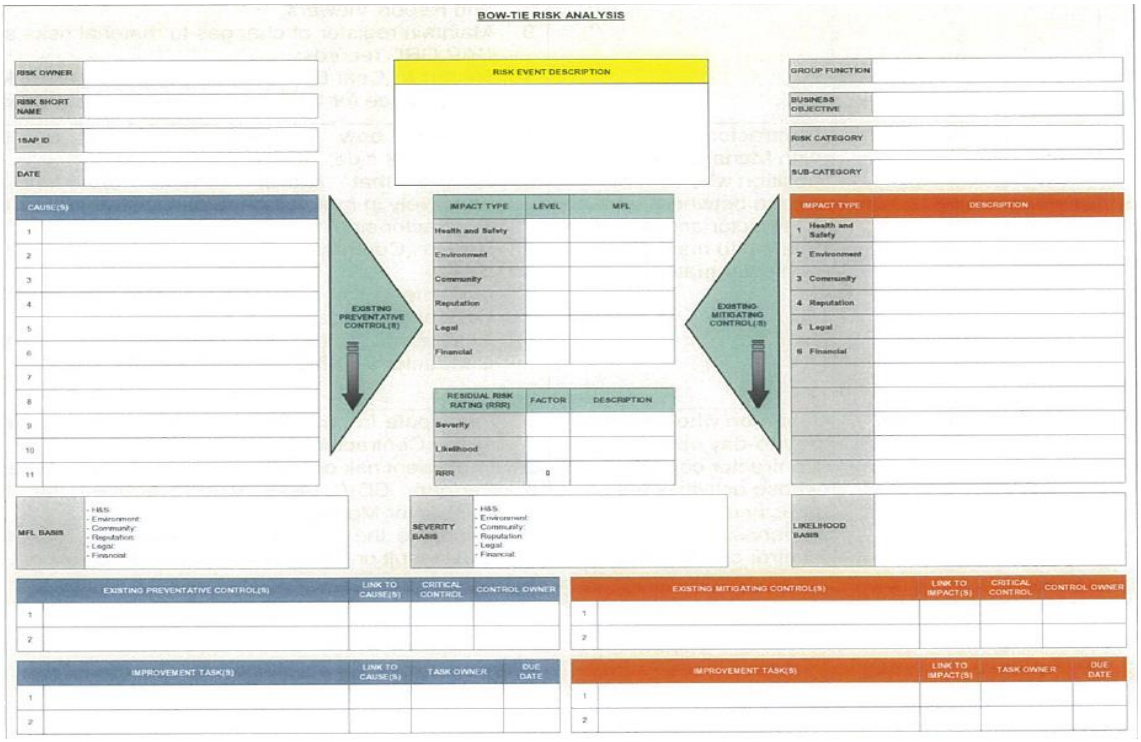

Figure 2. PT X Bow Tie Analysis Template

The risk event descriptions are vehicle rolled over, hit another vehicle or heavy equipment, worker or member of the community. There are 13 items of what could have been the cause of the event and is laid out in the left section of the bowtie. These are driver unsafe behavior, unfit driver, incompetent driver, noncompliance vehicle, vehicle not well maintained, mechanical failure, inadequate road design, unsafe environmental condition, traffic density, community entering the mine area, blind spot and lack of radio communication. After all of the causes are identified, the existing preventive controls are also identified to ensure that it addresses the causes. In this example, there are 13 existing controls to prevent the event from occurring. From 13 controls, using the decision tree, 6 critical controls are identified. These critical controls are company driving license, maintenance of vehicles as per OEM standards, separation of light vehicles and heavy equipment in mine pit, fit for work testing, positive radio communication and the availability of spotter in a blind spot

area. The few amounts of critical controls are controls that are really crucial and able to prevent an event from initiating.

On the right side is the impact of what the event could cause, which is from safety perspective, multiple fatalities. There are 6 identified mitigation controls and using the same decision tree, one critical control is identified, which is the use of New Car Assessment Programme (NCAP) 5 Star rated vehicle. The NCAP 5 Star rated vehicle is a certain type of vehicle that has undergone an extensive crash test and is proven to have the maximum protection for both adult and child occupant. The vehicle is also equipped with electronic stability control (ESC), three-point inertia seatbelts completed with seat belt reminder (SBR) and airbags on the driver and front passenger side.

Once the critical controls are well identified, the organization established performance standards. An example of this exercise is when defining performance standards for the separation of vehicle and heavy equipment in the mine pit. The design standard for this control is set so that 1. Segregation of lane between vehicle and heavy equipment is implemented, 2. If there is a need for vehicle to enter the pit and interact with heavy equipment, all heavy equipment shall stop operating. The frequency of the critical control verification is set to monthly and the test of effectiveness of the control is set to three monthly bases.

The critical controls are then assigned to a person known as the control owner. This person is responsible to ensure that the controls are implemented on the field and test that the controls are effective. The control owner then reports his or her verification on the field to the Critical Risk Owner, where the risks are reviewed and the effectiveness of controls are rated, as adequate or deficient or significantly deficient.

If the controls are rated as deficient or significantly deficient, then an action plan is developed. The critical risk owner and the control owner would need to review on whether there are better ways for the controls to be effective.

Table 1. PT X Critical Control Rating (Adapted from BHP Billiton)

Rating	Explanation
Adequate	No open issues and the design, operation and verification of the critical control are appropriate, effective and achieves the control objective
Deficient	The design or operation or verification of the critical control is not appropriate, effective or only partially achieves the control objective. Any open issues are treated as low or medium
Significantly Deficient	The design or operation or verification of the critical control is not appropriate, effective or does not achieve the control objective. Any open issues are rated as high

3. RESULTS

Benefit of CCM Implementation in Indonesia

Although organizations are required to undertake an analysis of the effectiveness of their controls, in Indonesia alone, there are only a few that have robust process. Most of the companies reviewed their controls on regular basis e.g. six-monthly bases, or if there are new activities, or if accidents occurred. Doing this, would only assess the controls only when it goes wrong or in other words when an incident occurred. This is quite straightforward as we would know instantly that the control is not effective.

The safety risk management in PT X applies a combined system of the normal approach of doing risk assessment with an enhance focus into barriers/controls management. The organization has also put the safety responsibility in its line management team. This has put its HSE department into the right function as advisor and has the capacity of providing support to line management and other workers in the organization. This is the level commitment in which the organization has placed in order to put 'Safety is Everybody Responsibility' into practice.

CCM, as stated in the introduction, is a part of risk management and is a very

useful tool to assist companies to focus in implementing the right controls and be proactive in reviewing on whether the controls are actually effective for those considered as material unwanted events or critical risks.

The fewer quantity of critical controls for critical risks, compared to common risk assessment method, made the risk to be more easily to manage. The case study showed that rather than to verify all 13 controls simultaneously, control owners now have only 6 critical controls for the vehicle interaction event. This is a simpler approach that helps organizations reduce their safety system complexity.

The CCM, with the critical control decision tree, is also able to provide the organization with the drive to implement correctly the hierarchy of controls and select physical barriers that prevent event initiation. Segregation of vehicle is the perfect example of how safety starts from the beginning - safety in design - where people are making the effort proactively by recognizing the risk and that engineering controls are put in place as to provide the maximum protection to the workers. As for the mitigating critical control, the selection of an NCAP 5 Star rated vehicle is evidence of how technology is used to provide suitable protection to workers by being able to mitigate the impact if an incident had occurred.

By appointing control owner and critical risk owner, the system allows clearer accountability and escalation protocols should issue are identified. Issues regarding the controls are also able to be identified at an early stage and not by waiting for accidents to occur, thus leads to better governance and support the management in making good decision with regards to safety.

From the lagging indicator perspective, this company has improved their incident statistics. In particular with the implementation of segregation controls, incident involving interaction of vehicle and heavy equipment in the mine pit was significantly reduced as the risk of vehicle interacting was reduced by the use of separate lane for light vehicle and heavy equipment. All of these are results of an improved operational risk management.

4. DISCUSSIONS

Challenges in Indonesia

The implementation of CCM in Indonesia is not without challenges. The first challenge is the commitment in risk ownership. It took months of training and socialization on how the CCM approach works as integrated part of the company established management system. The second is the level of risk perception both the leadership and workers team have on risk. The organization has difficulties in aligning of what is considered to be acceptable and practicable in implementing risk controls. And then there are issues with resources. The organization has restricted number of about 50 people of what they called as an owner's team. Managing business partners of more or less 800 workers, the limited resources made it difficult for the system to be implemented. Last but not least is the issue of conflict of interest. As the maturity of the organization was limited to only at compliance level, stepping up the game to beyond than what is required, requisite a change of mindset, focus, and see safety as tools to achieve higher business result instead of the otherwise.

5. CONCLUSIONS

Even though the challenges are there, there is no easy way to improve our safety performance in Indonesian mining industry, then to create change of mindset from reactive to proactive. Management of barriers or controls especially the critical ones are of the essence. Organizations could not simply put the safety of the workers in the hand of regulation and compliance. In safety, we need to also do the right thing – ethically speaking – and the smart thing – business wise. Organizations would need to take on effective leadership, meaning that the line management and workers need to share leadership responsibilities. The people in the organization need to build support for the CCM approach, promoting the approach and make the CCM sustainable by enhancing the process as it is seen as applicable. Participation of the workers are of the importance in order for the approach to be successful. With all of these, the swiftest way to have the approach implemented is by creating addendum of the requirement and include them into one of existing safety regulations as

improvement to the current system. At the end of the day, organizations in Indonesia are here to do good business and it could only be successfully achieved if everyone is home safe, every day.

Acknowledgement

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Analysis of Workload On Complaint of Musculoskeletal Disorders (MSDs) in Furniture's Workers at Surabaya City 2017

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Abstract

Any workplace have could compromise the health and safety of a worker. Health and safety service efforts need to be implemented in the workplace, whether in the formal sector or in the informal sector. Based on a study conducted on 9482 workers in 12 city at Indonesia that the health disorders complained by workers is generally a disturbance of MSDs (16%). Furniture Industry is one of the businesses in the informal sector that have risks of hazard but less realized from workers and owners. The process of work likes cutting and subtilize the wood, assembled the wood into furniture and all activities was did with wrong posittion, repetitive frequency of activity and long duration would be risk for muskuloskeletal disorders (MSDs) to workers.

This research was conducted in Furniture Industrial area of Jalan Semarang, Surabaya City which aims to knew the health conditions of workers related workload and complaint of MSDs during work in Furniture Industry. This type of research is analytic observational with cross sectional approach with total sampling 40 of worker. Data were obtained from workplace observation and measurements on work positions using REBA / RULA and workload assessment based on caloric needs. Nordic Body Map using to see a description of MSDs complaints to workers.

The results of the MSDs assessment showed that most furniture's workers (62.5%) feel the MSDs complaints, based on chi square test between workload and MSDs complaints showed that there was a significant relationship between workload (0.033),

working position (0.002), duration of work (0.000) and working periode (0.000) with MSDs complaints.

The conclusion of this research is the more heavy workload of furniture workers will tend to feel complaints MSDs so it is advisable to the furniture workers should do an ergonomic work position during work, duration of work not more than 8 hours / day and should to get exercise (warm up) briefly 5-10 minutes before and after work,.

Keywords: MSDS, furniture's work

1. INTRODUCTION

Based on BPS data, the number of workforce and work of 2012-2014 shows that there is an increase in the labor force participation rate from the year 2012 of 66.9% and in 2014 by 69.2%[1]. The growth of labor and industry can lead to various positive impacts and negative impacts. One of the negative impacts is the increasing accidents due to work and occupational disease, because every workplace have contains potential hazard can be affected to health of worker. The magnitude of the risk of accidents and occupational diseases depends on the type of production,the technology and material used and the environment of work.

According to data from the International Labor Organization (ILO) in 2012 showed globally estimates 337 million work accidents has occurred with 2.3 million deaths from work occurring each year, which an estimated 1 worker in the world dies every 15 seconds due to workplace accidents and 160 workers suffering from occupational diseases. The results of occupational health and safety implementation report from 26 Provinces at Indonesia 2013 show from 2.998.766 common disease perceived by the worker, as much 428,844 case related with occupational disease [2].

Musculoskeletal Disorders (MSDs) is one of occupational diseases in workers but often lack special attention because they are considered trivial by experienced workers and owner of the workshop. Some industries both the informal and formal sectors didn't understand what are the risk factors for the causes of Musculoskeletal Disorders

(MSDs) disease,moreover this occupational disease can affect the productivity and effectiveness of workers in completing their work.

Musculoskeletal Disorders (MSDs) usually occurs indirectly but is an accumulation of small or large collisions that occur continuously and in a relatively long time depending on the sense of weight and mild tissue trauma. Musculoskeletal Disorders (MSDs) is a pathological condition that affects the normal functioning of the fine tissues of the Musculoskeletal system that includes the nervous system, tendons, muscles and supporting structures such as an interventional discuss that can cause inflammation and weakening of body functions.[3]

One of Europe's biggest occupational disease and felt by millions of workers is Musculoskeletal Disorders (MSDs), based on research conducted, 31% complained of back pain and 27% felt muscle pain. The United States, a developed country in the manufacturing industry, has noted that work related musculoskeletal disorders (WMSDs) is the leading cause of Occupational Diseases and loses 846,000 working days each year[4].

Based on a study conducted on 9482 workers in 12 city at Indonesia that the health disorders complained by workers is generally a disturbance of MSDs (16%), cardiovascular disease (8%), nervous system disorders (6%), respiratory disorders (3%) and ENT (1.5%). Results of laboratory studies conducted by Center for Health Studies and Ergonomics ITB showed 40% -80% of workers felt musculoskeletal complaints after working [5]. Factors can lead to complaints of musculoskeletal disorders (MSDs) are the age of the worker, the employment, the job position and the workload[6]. MSDs disturbance can be an important problem because it can decrease work productivity, lost working time, handling costly and increase the risk of work accident.

Excessive physical loading can affect the occurrence of pain or complaints on the musculoskeletal system, the burden physical is not to exceed 30-40% of the maximum work force capacity with 8 hours work a day. The heavier the workload or increase

working time will cause muscle fatigue characterized by symptoms of tremor or pain in the muscle[7]. Furniture Industry is one of the businesses in the informal sector that have risks of hazard but less realized from workers and owners. The process of work likes cutting and subtilize the wood, assembled the wood into furniture and all activities was did with wrong posittion, repetitive frequency of activity and long duration would be risk for muskuloskeletal disorders (MSDs) to workers.

Surabaya is the largest metropolitan city in eastern Indonesia, there are various facilities that support trade and services that have the potential to grow and develop so it needs to be supported industrial activities. One of the industries in the informal sector that develops in Surabaya is Furniture Industry was located at semarang street, pasar turi area. The results of the initial survey conducted on furniture's workers through interviews using the Nordic Body Map questionaire it's known that most workers feel a complaint on the neck and shoulders (Upper Extremitas) because the process of cutting and subtilize the wood are the activity most often done every day over with repetitive frequency.

From that background it is seen that workers in the meubel industry is one of the workers at risk for Musculoskeletal Disorders (MSDs), because the meubel industry is one of the informal industry so that the health of its workers get less attention from the owner workshop and government. This research purpose to analysis of workload on complaint of Musculoskeletal Disorders (MSDs) in Furniture's Workers at Surabaya City.

2. METHODS

The type of research used is observational research and analytic research with cross sectional study design to analysis of workload on complaint of Musculoskeletal Disorders (MSDs) in Furniture's Workers at Surabaya City. This research was conducted in Furniture Industrial area of Jalan Semarang Surabaya City with total sample 40 furniture workers which taken by using accidental sampling technique.

The independent variabel in this research are workload,work position, working period and duration of work and the dependent variabel is complaint of Musculoskeletal Disorders (MSDs). Data was collecting use interview techniques, questionnaires using Nordic Body Map and REBA/RULA assesment, observations with the aid of a checklist and documentation. Data was obtained then analyzed using SPSS program, analysis bivariate data using chi square test.

3. RESULTS

a. Characteristics of Respondents

Tabel 1. Frequency Distribution Relating Respondent Characteristics on Furniture's Workers at Surabaya City,2017

Characteristics of Respondents		**n**	**%**
Age	36-60	27	67.5
	20-35	13	32.5
Type of Work	Cut, Assemble and Subtilize the Wood	22	55.0
	Cut and Subtilize the wood	13	32.5
	Subtilize the wood	5	12.5
IMT	Normal	29	72.5
	Pre-Obesity	11	27.5
Work Position	Not Ergonomic	23	57.5
	Ergonomic	17	42.5
Working period (year)	>5 years	27	67.5
	1-5 yearssp	13	32.5
Duration of work (hour)	>8 hour/day	22	55.0
	8 hour/day	18	45.0
Workload	Heavy workload	21	52.5
	Medium workload	19	47.5
MSDS Complaint	There are Complaint	25	62.5
	No Complaint	15	37.5
Total		**40**	**100.0**

Tabel 1 showed that the characteristics of furniture's workers at Furniture Industries at Jalan Semarang whose became respondents in this study more workers over 35 years old as many as 27 people (67.5%) and 13 respondents the age less than 35. Distribution of respondents based on job characteristics showed, average working period of furniture's worker more than 5 years as many as 27 people (67.5%) with duration of work more than 8 hours/day. For the workload, as many as 21 respondent (52.5%) have a heavy workload and the remaining 19 people have a medium workload. From 40 furniture's worker whose become respondent in this study, only 17 respondent (42.5%)who did their work with ergonomic position and 23 respondent (57.5%) did their work with not ergonomic position, so 25 respondent felt complaint of Musculoskeletal Disorders (MSDs) while working or after finish their work.

b. Bivariate Analysis

Tabel 2. Bivariate analysis between independent variables with Complaint of Musculoskeletal Disorders (MSDs) in Furniture's Workers at Surabaya City, 2017

Work Factor (Independent Variabel)	Welder's Flash Complaint (Dependent Variabel)		Conclusion
	Probability Value (P-value)	Koefisien Value Correlation (r)	
Working periode (year)	0.000	0.560	Significant
Duration Of Work (hour)	0.000	0.650	Significant
Workload	0.011	0.372	Significant
Work Position	0.002	0.435	Significant

Tabel 2 showed statistical test result using chi square test to independent variable with complaint of Musculoskeletal Disorders (MSDs) in furniture's workers at Surabaya City, there have relationship complaint Musculoskeletal Disorders (MSDs)with working periode (0.000), duration of work (0.000), workload (0.011) and work position (0.002) in Furniture's Workers at Surabaya City.

Musculoskeletal system complaints generally was occur because of excessive muscle construction due to overloading of heavy workloads with long duration of loading [7]. In this study, used Nordic Body Map method to find out which parts of the body are experiencing Musculoskeletal disorders with a level of complaints ranging from discomfort (slightly painful) to very painful also most of furniture's workers feel MSDs complaints because workers always work with static work positions like standing for long time and then working with tools such as cutting machines and grinding machines which the work device has heavy load when lifted with one hand when working.

The result of this study are in accordance with study *European Survey on Working Conditions (ESWC)* that Musculoskeletal disorders are felt by workers, many felt on the body of the back of the neck, waist, and other upper truss muscles. On the body with complaints of back or lumbar back pain and upper limbs much due to the heavy work on odd positions performed repeatedly lifting heavy weights and postures that can not adjust to the position of the target object is done[8].

There some factors that can cause of MSDS complaints are age, sex, smoking habit, Body Mass Index, duration of work (hour), working period (years),work position and workload. In this research showed there are 4 factors can cause of MSDS complaints to the furniture's workers in Jalan Semarang are duration of work, working period, work position and workload.

Most of the workers who become respondent in this study was worked more than 5 years with duration of work more than 8 hour/day and all of them had MSDs complaints, because the longer a person's to work then Muscular endurance often used for work will decrease this happens because musculoskeletal disorders disease is a chronic disease that takes a long time to develop and manifest in one's body. The result of this study are in accordance with research conducted by Hendra and Rahardjo (2009)that workers who

have a working period of more than 4 years have a risk of 2.775 times compared with workers with a working period less than 4 years[9].

Doing the job needs to pay attention to the application of muscle power properly in order to obtain optimal muscle power. Musculoskeletal complaints generally occur due to excessive muscle contraction due to overloading of heavy workloads with long duration of loading. Oxygen supply to muscle decline, the carbohydrate metabolism process is inhibited and as a result there is accumulation of lactic acid that causes muscle pain[10].

Musculoskeletal complaints that was occur in furniture workers because heavy workload, excessive stretching of muscles in general often complained by the workers, where work activities require large mobilization such as lifting weights and repetitive movements[11]. In this study there is a significant relationship between workload with MSDs complaints. Excessive workload can cause excessive stretching of the muscles can reduce the thickness of the intervertebral disc or the element that lies between the spinal segments that will pose a risk of spinal pain. The result of this study are in accordance the statement of the Tarwaka which states that Excessive workload will result in good job stress physical and psychological and emotional reactions, such as headaches, musculoskeletal complaints and irritability[6].

Relationship of worker with work position and interaction of the workplace will determine the efficiency, effectiveness and productivity of work. Work Position of furniture's worker that working position with a standing position of tense / stiff, neck position that tend to bend and body position that tends to tilt. Work position in this research can be categorized as unnatural workposition (not ergonomic) and natural work position (ergonomics), most of the furniture workers working with unnatural positions(not ergonomic) so will be risk to have MSDs complaint. This result of this study in line with research was conducted by PT. Kresna Duta Agrindo Jambi that there was significant relationship between work position with MSDs complaint, which workers who

work with unnatural position(not ergonomics) are more likely to felt MSDs complaint(96%) than workers who work with a natural work position (4%)[5].

4. CONCLUSSION

Based on the results and conclusions of the discussion can be obtained as follows:

a. Most of the furniture's workers at Jalan Semarang feel MSDs complaints
b. There was significant relationship between duration of work, working period,working position and workload with Musculoskeletal complaints.
c. Extend working periods and duration of work will increase the symptoms of Musculoskeletal complaints because they will do the same job and with repetitive motion.
d. Excessive workload can cause excessive stretching of the muscles can reduce the thickness of the intervertebral disc or the element that lies between the spinal segments that will pose a risk of spinal pain.
e. Work Position of furniture's worker that working position with a standing position of tense / stiff, neck position that tend to bend and body position that tends to tilt will be effected to MSDs complaint.
f. There was suggestions that can recommended to the owner's of furniture industrial must provide the personal protective equipment (PPE) was appropriate to all workers and the owner gives an appeal to the workers to do little stretching while working.
g. Suggestions to all furniture's worker should do an ergonomic work position during work, duration of work not more than 8 hours / day and sometimes to get exercise (warm up) briefly 5-10 minutes before and after work, this case to do for the muscles will not stiff.

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Ethical approval

UNUSA

KOMISI ETIK PENELITIAN KESEHATAN
UNIVERSITAS NAHDLATUL ULAMA
SURABAYA

KETERANGAN LAIK ETIK
("*ETHICAL CLEARANCE*")

No. 177/EC/KEPK/UNUSA/2017

KOMISI ETIK PENELITIAN KESEHATAN UNIVERSITAS NAHDLATUL ULAMA SURABAYA, TELAH MEMPELAJARI DENGAN SEKSAMA RANCANGAN PENELITIAN YANG DIUSULKAN MAKA DENGAN INI MENYATAKAN BAHWA PENELITIAN BERJUDUL :

ANALISIS BEBAN KERJA TERHADAP KELUHAN PENYAKIT *MUSKULOSKELETAL DISORDERS* (MSDs) PADA PEKERJA INDUSTRI MEUBEL DI KOTA SURABAYA TAHUN 2017

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UNIT/LEMBAGA/TEMPAT PENELITIAN

Kawasan Jalan Semarang Kota Semarang

DINYATAKAN LAIK ETIK.

Surabaya, 09 Agustus 2017

KETUA KEPK

UNUSA

Komisi Etik Penelitian Kesehatan

(Danny Irawan, dr., Sp.PD)

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Synchronization Of Panca Nirbhaya With SMKP Minerba/MSMS 3814 (Regulation Of The Minister Of Energy And Mineral Resources Of The Republic Of Indonesia Number: 38 Year 2014)

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Abstract

"MSMS 3814" is based on regulation of the Minister Of Energy And Mineral Resources No. 38/2014 part of the company's management system to control risk in mining safety process and occupational health of mining operations. PT. HPU has started to socialized and applied this system since 2015. This system integrated into the application system of Mining Safety & Environmental Management system which already existed on 2012 in PT. HPU, it called Panca Nirbhaya. Panca Nirbhaya is a set of tools to help the management and employees to control and manage the unnecessary costs from accidents (for example costs due to injuries, property damage, diseases caused by work, and claims from environmental pollution). On 2015 PT. HPU added MSMS 3814 Standard in Panca Nirbhaya.

This research aims to assess the relationship between MSMS 3814 with Panca Nirbhaya. This study use a descriptive method and quantitative approach to secondary data as the source of data. Data obtained in the audit criteria of MSMS 3814 and Audit criteria of Panca nirbhaya. The data category presented using patterns of system P-D-C-A. The data were analyzed statistically using the Chi Square test, from the analysis obtained results that P value = 0.000, p-value < alpha (0.05) & R value = 0,732.

The results showed a significant relationship between MSMS 3814 with Panca Nirbhaya. It happens because Panca Nirbhaya has been synchronized with Minister Of Energy And Mineral Resources No. 38/2014 about MSMS 3814 since 2015 and MSMS 3814 & Panca Nirbhaya uses the same pattern when formulated, namely patterns of PDCA "Plan, Do,

Check, Act". It happen because Panca Nirbhaya has been synchronized with Minister Of Energy And Mineral Resources No. 38/2014 about MSMS 3814 since 2015.

Keyword : MSMS 3814, Mine Safety Management System, Panca Nirbhaya, Mine Safety & Environment Management System, Safety Management System, Occupational, Health and Safety Management System

1. INTRODUCTION

Mining is an activity of precipitating precious material deposits and economic result from the Earth's crust, both mechanically or manually, on the Earth's surface, beneath the surface of the earth and below the surface of the water. The results of this activity include, oil and gas, coal, iron sand, nickel ore, bauxite ore, copper ore, gold ore, silver and manganese ore. Stages of mining activities include: prospecting and general research, exploration, mining preparation and development, exploitation and processing/refining/purification. Mining is one of the industries classified as a company that has high potential hazard, in accordance with PP/ Government Regulation number 50 year 2012 about the implementation of OHS Management Systems: chapter 16 paragraph 2 stating the meaning of a company that has a high potential danger among others companies engaged in mining, oil and natural gas. In every mining process, each stage will not be separated from the dangers and risks. According to Huang et al., (2015) the mining industry is one of the industries with the highest level of risk. So that the implementation of Occupational Safety and Health Management System in mining plays an important role. In mining industry we know the existence of Mine safety management System/

The Mine Safety Management System, hereinafter reffered to as MSMS 3814, is part of the overall enetrprise management system in the context of controlling mining safety risk comprising safety and health of mining, and safety of mining operations. "MSMS 3814" is based on regulation of the Minister Of Energy And Mineral Resources No. 38 year 2014 part of the company's management system to control risk in mining process and occupational health & safety of mining operations.

MSMS 3814 is formulated with several considerations, among others: complying with the provisions of the law and guarantees of safe and healthy miners, efficient and productive mining operations in the conduct of mining business activities, it is necessary

to implement Mine Safety Management System. MSMS 3814 must be applied by every company engaged in mineral and coal.

The purpose of MSMS 3814 implementation is :

a. Improve the effectiveness of Mine safety planned, measureable, structured, and integrated;
b. Prevent mine accident, occupational diseases, and hazardous events;
c. Create safe, efficient, and productive mining operations; and
d. Create a safe, healthy, comfortable, and efficient workplace to increase productivity.

By looking at the purpose of MSMS 3814 implementation above is very appropriate if the company wants safe and improve its health & safety performance is to apply MSMS 3814 in his company. This is in accordance with the journal of Mitichison & Papadakis (1999) which states that by implementing Safety Management System can reduce losses and improve the safety & health performance in the company.

MSMS 3814 formulated taking into account the aspects that exist in the legislation, the characteristics of mining which is different from other industries also consider academic aspect. This academic consideration is seen from the cycle in MSMS3814 which refers to the pattern of “PDCA”.

PDCA, short for "Plan, Do, Check, Act", is an iterative four-step problem-solving process commonly used in quality control. This method was popularized by W. Edwards Deming, who is often regarded as the father of modern quality control so often called Deming cycle. Deming himself always refers to this method as the Shewhart cycle, from the name of Walter a. Shewhart, who is often regarded as the father of statistical quality control. By using PDCA pattern then MSMS3814 will be very easily synchronize with existing systems in every company engaged in mineral and coal mining.

After issuing regulation on the implementation of MSMS3814 in the year 2014, then the Government requires every company engaged in mineral mining and coal apply and socialize the MSMS3814 in The year 2015 by doing GAP analysis of MSMS3814 with safety Management system and occupational health that exist in his company. In the year 2016 every company engaged in the mineral and coal mining must perform internal audit MSMS 3814

PT Harmoni Panca utama is one of the mining contracting service company. PT Harmoni Panca utama is a national company established on January 25, 2011 and focuses only on mining contracting service. PT Harmoni Panca utama is a combination of two companies with different backgrounds and interests, namely PT Harmoni Mitra Sentosa and PT Panca Sejahtera Mandiri. PT Harmoni Mitra Sentosa is a private company focused on mining with a strong financial structure. And PT Panca Sejahtera Mandiri is a private company that has strong competence in providing mining services.

PT Harmoni Panca Utama (HPU) is a company commited to providing first class costumer-centric mining services in accordance with good mining practices. The Scope of HPU activities as a mining contractor is ranging from land clearing activities, overburden removal activities, coal pickling activities, and coal transport from mine to costumer defined places. PT HPU has a mining Safety, Health and Environmental Management System (HSEMS) called PANCA NIRBHAYA.

Panca Nirbhaya is a set of tools used to help the management and employees to control and manage the unnecessary costs that are resulting from accidents (for example costs due to injuries, property damage, diseases caused by work, and claims resulting from environmental pollution).

Panca Nirbhaya was formulated using the PDCA pattern "Plan, Do, Check, Act" and integrate the OHSAS 18001 and ISO 14001 standards. This system is used to analyze, detect, create solutions to these problems, which can result in increased safety, health and environmental performance and will ultimately save costs due to accidents. This system has been used in the internal scope of PT Harmoni Panca Utama, the implementation of this system has been done since 2012 against all projects and including applied to new projects. The system consists of five (5) Main Elements and five-five (55) sub-elements described in the contents of this manual. The scope of this system includes all parts / activities / activities in the business process of the company as a coal mining services, both in the Head Office and all projects that become its responsibility.

In addition to environmental management, the system manages all activities undertaken by the company in accordance with existing agreements and by taking into account information from related parties including external parties. Panca Nirbhaya consists of 5 main elements namely P A N C A. Those 5 main elements are :

a. Element 1 Planning & Organizing ;
b. Element 2 Accountability, Communication & Training;
c. Element 3 New Design, Management of Change, Operational control & Emergency;
d. Element 4 Checking, Monitoring, Incident Investigation & HSE Audit;
e. Element 5 Annual Management Review & Continuous Improvement.

PT HPU as mineral and coal mining service company is one of the companies that must apply safety, health and environmental management systems in their operations. In addition to PT HPU as a company that wants to compete in national and international scale, the company has also certified OHSAS 18001 and ISO 14001. With the regulation of Safety management system, PT HPU must integrate Panca Nirbhaya system with MSMS3814, OHSAS 18001 & ISO 14001.

2. METHODS

This research uses descriptive method and quantitative approach to secondary data as data source using the existing audit criteria data in MSMS 3814 and using Audit criteria in Panca Nirbhaya. The audit criteria data are then categorized using the PDCA pattern and searching for the relationship between the two criteria by using the chi square statistical test. The purpose of this study is to see the relationship between MSMS 3814 with Panca Nirbhaya, by comparing the audit criteria of MSMS 3814 with audit criteria Panca Nirbhaya and looking at the elements in MSMS 3814 with elements in Panca Nirbhaya.

3. RESULTS

MSMS 3814 and Panca Nirbhaya have the audit criteria, from which the data is then categorized using the PDCA pattern "Plan, Do, Check, Act" and look for the relationship between the two criteria. The clause pattern present in the MSMS 3814 and Panca Nirbhaya is seen in (fig. 1-1 & 1-2).

Figure 1-1. Criteria MSMS 3814 & Criteria Panca Nirbhaya

No	CRITERIA MSMS 3814	CATEGORY
1	Policy	1
2	Policy Formulation	1
3	Contents Of Kebiiakan	1
4	Policy Assignmen	1
5	Communication Policy	1
6	Review Policy	1
7	Planning	1
8	Initial Review	1
9	Risk Management	1
10	Identification of and compliance with the provisions of the Legislation and related Requirements	1
11	Goal setting, goals, and programs	1
12	Work plan and budget of Mining Safety	1
13	Organization And Personnel	1
14	Preparation and determination of the structure of the Organization, tasks, responsibilities, and authority	1
15	The designation of the Summit, the heads of underground mines, and/or head of a Dredger for mining companies	1
16	The Designation Of The Mining Service Companies To Person in charge of the operational	1
17	Appointment of person in charge of operations For the mining service companies	1
18	Appointment of Supervisors operational and Supervisory Techniques	1
19	The Appointment Of A Special Mining Engineering Personnel	1
20	Establishment and determination of Mining Safety Committee	1
21	The Designation Of The Emergency Response Team	1
22	The selection and placement of Personnel	1
23	Organizing and implementation of education and training as well as Job Competency	1
24	Preparation, designation, and application of Mining Safety Communication	1

No	CRITERIA MSMS 3814	CATEGORY
25	The Management Of Mining Safety Administration	1
26	The preparation, Implementation, and documentation of the procedures of Consultation, Participation, motivation, and awareness of the application of MSMS 3814	1
27	The implementation of the	2
28	Implementation Of The Management Of Operational	2
29	Implementation Of The Management Of The Working Environment	2
30	The Implementation Of Occupational Health Management	2
31	Implementation Of Management Mining Operational	2
32	The management of explosives and Blasting	2
33	The determination of System design and Engineering	2
34	Determination Of The Purchasing System	2
35	Monitoring and management of the mining service companies	2
36	Management Of Emergencies	2
37	The provision and preparation of first aid	2
38	Implementation of safety outside of work (off the job safety)	2
39	Evaluation And Follow-up	3
40	Monitoring and performance measurement	3
41	Implementation Of Safety Inspections Quarries	3
42	Evaluation of compliance with the provisions of the Legislation and Related Requirements	3
43	An investigation into the accident, Dangerous Occurrence, and diseases caused by Work	3
44	Evaluation Of Management Of The Mining Safety Administration	3
45	Internal audit the implementation of Safety management system	3
46	Follow Up Discrepancies	3
47	Documentation	3
48	Drafting Manual MSMS 3814	3
49	Document Control	3
50	Recording Control	3
51	Determination of the types of documents and recordings	3
52	Management Review	4

Figure 1-2. Criteria Panca Nirbhaya

No	CRITERIA PANCA NIRBHAYA	CATEGORY
1	Basic Policy On Safety, Health And Environment	1
2	The Identification Of Hazards, Risk Assessment And Control Control	1
3	Legislation/Regulations And Other Requirements Of The HSE	1
4	Goal, Goal/Target, And Program	1
5	Monthly Reports And Statistics On Work Safety, Health And Environment	1
6	Committees And Representatives Safety, Occupational Health And The Environment	1
7	Control Of Documents And Archives	1
8	The Competition Award & HSE	1
9	Appointment Delegation Authority &	1
10	Inspection System Of Observation Tasks & Planned At High Risk	1
11	Reporting Of Hazards	1
12	The Talks Are Early Shift And Induction Of HSE	1
13	HSE Information Boards & Board Performance HSE	1
14	External Communication	1
15	Bulletin And Display Boards HSE	1
16	Training Needs Analysis And Formal Training of HSE	1
17	The Test/Training License To Operate The Equipment	1
18	Approval System For The Design, Methods And New Processes, Change Management And Certification Of Equipment	2
19	Workplace Governance Management	2
20	Inspection System (Implementation Of Daily Care)	2
21	Planned Maintenance System	2
22	Job Safety Analysis And High-risk Task Procedure	2
23	Control Of Motorized Equipment	2
24	Control Of Pressurized Tube & Vessel	2
25	Control Equipment Lifting	2
26	Control Of Portable Ladders & Scaffold	2

No	CRITERIA PANCA NIRBHAYA	CATEGORY
27	Portable Electric Control & Installation	2
28	Protective Control On The Machine	2
29	Control Of Portable Gadgets	2
30	The Management Of Contractors And Purchase	2
31	Work Permit	2
32	System Lock Out Tag Out	2
33	Signs, Symbols, Labels & Color Code	2
34	Control of harmful substances are poisonous and Toxic hazardous materials Waste	2
35	Management Of Hydrocarbons	2
36	Management Of Outdoor Deposition	2
37	Rehabilitation And Reclamation	2
38	Conservation Of Natural Resources, Flora And Fauna	2
39	Waste Management	2
40	Medical Check Up	2
41	Hygiene and sanitation Facilities	2
42	Health Promotion	2
43	The Management Of Clinics And Emergency	2
44	Fire Prevention And Protection	2
45	Alarm Systems And Emergency Exercises	2
46	Survey And Management Of Ergonomics	2
47	The system of control and record keeping of personal protective equipment	2
48	Investigation Incident, non conformity Corrective Actions	3
49	Incident Report & Inciden alert	3
50	Randoms Checks	3
51	Measuring And Monitoring	3
52	Internal And External Audit	3
53	Annual Management Review	4
54	The HSE Advising System	4
55	The HSE Performance Improvement Team	4

From the table shown in MSMS 3814 consists of 7 Chapters and 52 sub chapters, as for the 7 chapters are:

a. Chapter I Policies
b. Chapter II Planning
c. Chapter III Organization & Personnel
d. Chapter IV Implementation
e. Chapter V Evaluation and follow-up
f. Chapter VI Documentation
g. Chapter VII Management Review.

While Panca Nirbhaya consists of 5 main elements namely P A N C A and 55 Sub elements, as for the 5 elements are :

a. Elemen 1 Planning & Organizing ;
b. Elemen 2 Accountability, Communication & Training;
c. Elemen 3 Inspection / New Planning, Change Management, Operational Control & Emergency Measures;
d. Elemen 4 Investigation, Monitoring, Incident Investigation and HSE Audit;
e. Elemen 5 Annual management review and ongoing improvement.

MSMS 3814 consists of 52 sub chapters and Panca Nirbhaya consists of 55 sub elements. The criteria data are then categorized using the PDCA pattern, each sub-chapter and sub element categorized into the Plan-Do-Check-Act pattern.

Figure 2-1 Summary pattern "PDCA" MSMS 3814 & Panca Nirbhaya

Resume Data		
Criteria	MSMS3814	Panca Nirbhaya
Plan	26	17
Do	12	30
Check	13	5
Act	1	3

The results of categorization pattern PDCA MSMS 3814 & Panca Nirbhaya is (Fig 2-1)

From the categorization results obtained results:

a. In Category Plan: in MSMS 3814 Sub elements are classified in the Plan category amounted to 25 Sub Chapters, while In Panca Nirbhaya Sub Elements belonging to the category Plan amounted to 17 Sub Elements.
b. in the category Plan: in MSMS 3814 Sub elements belonging to the category of DO amounted to 12 Sub Chapter, while In Panca Nirbhaya Sub Elements belonging to the category of DO amounted to 30 Sub Elements.
c. in the category Check: in MSMS 3814 Sub elements belonging to the category Check amounted to 13 Sub Chapter, while In Panca Nirbhaya Sub Elements belonging to the category Check amounted to 5 Sub Elements.
d. in the category of Act: In MSMS 3814 Sub elements belonging to the category of Act amount to 1 Sub Chapter, while In Panca Nirbhaya Sub Elements belonging to the category Act amounted to 3 Sub Elements.

From the data categorization is then tested by using statistical test of Chi Square, and got the result P value = 0.000, with the result then p-value <alpha (0.05) with R value = 0,732 there is significant relation between MSMS 3814 with Panca Nirbhaya.

4. DISCUSSIONS

From the results of categorization between MSMS 3814 and Panca Nirbhaya got significant result with value of P value = 0.000 and R value 0,732 or 73,2%, from the test there is significant relation between MSMS 3814 and Panca Nirbhaya. This significant relationship is caused by both systems using the same pattern in the system-making process by using PDCA pattern "Plan, Do, Check, Act".

MSMS 3814 itself in the compilation process is formulated by using PDCA pattern aims for this system can be integrated with existing systems in the company, this is in accordance with the definition of MSMS 3814 No. 38 Year 2014 paragraph 1 namely MSMS 3814 is part of the company's overall management system in the context of controlling mining safety risks comprising mining safety and health (OHS), and mining operations safety. By using the PDCA pattern, the system will be very easily synchronized and integrated with the existing enterprise systems, this is in accordance

with Clare Gallagher's opinion: 2001: The integration of OHSMS into broader management systems is regarded in the literature and in consultations as necessary for effective OHSMS.

Furthermore, in the formulation of the MSMS 3814 the government also involves stakeholders including involving representatives of mining companies. PT HPU as one of the mining service companies including being a service company representative is also directly involved in the process of MSMS 3814 formulation. PT HPU has also made synchronization and adjustment of elements in Panca Nirbhaya referring to the existing provisions in MSMS 3814. PT HPU as a mining service company is also required to apply MSMS 3814 so that synchronization process must be done and has been done.

The synchronization process done by PT HPU in accommodating MSMS 3814 since the regulation issued by Ministry of Energy and Mineral Resources in the Year 2015 is by doing GAP Analysis MSMS 3814 in 2015. Then in Year 2016 PT HPU also conduct internal audit MSMS 3814 measure the implementation of mining safety management system in internal company. After carrying out internal audits PT HPU has also reported the internal audit of MSMS 3814 to the Technical and Environmental Director (Chief Inspector of Mining) of the Ministry of Energy and Mineral Resources, in accordance No: 3200 / 37.04 / DBT / 2016 on the delivery of reports internal audit of the implementation of the mine safety management system.

5. CONCLUSIONS

The results showed a significant relationship between MSMS 3814 with Panca Nirbhaya. It happens because Panca Nirbhaya has been synchronized with Minister Of Energy And Mineral Resources No. 38/2014 about MSMS 3814 since 2015 and MSMS 3814 & Panca Nirbhaya uses the same pattern when formulated, namely patterns of PDCA "Plan, Do, Check, Act".

In addition PT HPU as a mining service company has made the insertion with existing elements in Panca Nirbhaya on MSMS 3814, so that existing Panca Nirbhaya has accommodated the provisions in MSMS 3814.

PT HPU as a mining service company has integrated the Minerals and Coal Mining Safety Management System into the Company's Occupational Safety, Health and Environmental Management system called Panca Nirbhaya.

PT HPU as a mining services company has also contributed in the process of formulating Regulation Of The Minister Of Energy And Mineral Resources Of The Republic Of Indonesia Number: 38 Year 2014.

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Public Places Wi-Fi Login Based Hazard Identification Using Redirect Survey Method in Developing Countries to Increase People Awareness to Public Safety

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Abstract

The failure to identify hazards that could have been overcome is one of the root causes of workplace incidents,accidents and illnesses[1.2]. Occupational health and safety is a multi discipline field and hazard does not only exist in industry, it also exists in public places and managing public safety is everyone's responsibility[3,4]. Technology keeps improving. The percentage of people in developing ncountries who own smartphones and use the Internet has risen in the past two years[5]. Nowadays people become respondent for a redirect survey page when using public wifi[6]. The purpose of this study is to evaluate the possibility of conducting hazard identification in the same method which is by becoming respondent in redirect survey about hazard identification based on WiFi login in public places. This research used literature review on scientific journals and data reports using keywords related to 'hazard identification' and 'public WiFi usage'. The result is there is a possibility of hazard identification to be conducted in redirect survey method based on WiFi login in public places since our findings confirmed that most customers appreciate the provision of free WiFi in the places they visit and recent Kaspersky Lab study(as stated on ITRC study) indicated that using public networks became the most common way used to access internet[7,8]. However,before government making it into one integrated system, more research should be conducted. Practical implication of this result should be designed to people that knows the place well so they can identify the hazard properly as well as to increase awareness to public safety responsibility.

Keywords: hazard identification, on line based, public safety

1. INTRODUCTION

Developing countries are known for the geographical hazards which is greater than developed countries. From longstanding to emerging hazards, environmental factors are a root cause of a significant risk of accidents, disease, disability or even death. These include: poor water quality, physical hazards, and sanitation; vector-borne diseases; poor ambient and indoor air quality; toxic substances; and global environmental change [9].

Most of the developing countries still neglect occupational health and safety aspect because of the social, economic, and political challenges. The conventional workplace oriented occupational health and safety has proven to be inadequate for decreasing accidents and make sure people's safety. Comprehensive progress in occupational health and safety can be accomplished by linking occupational health and safety to the broader context such as public safety [10].

We acknowledge that the major reason for varying levels of safety between developed and developing countries is the differences of safety awareness [11]. Safety awareness especially in public places is important to determine rules and policy that can ensure people's safety in public places. Even though citizens of developing countries are still lack of safety awareness, but the citizens have already known about technology. Technology such as smartphone and internet is kind of primary needs for most people globally, include citizens of developing countries. Based on the data from Internet World Stats 2017, Asia has the biggest internet user globally (46.7%), i.e Indonesia has 132.700.000 internet users or 50.4% of Indonesia's population is an active internet users [12]. We can use this opportunity to raise people's awareness about public safety through smartphone and internet usage.

In principle, injuries and diseases are preventable. There are approaches to prevent these include, developing awareness of health and safety hazards among

workers, employers, and customers, identify and assess the hazards, and maintaining effective control and evaluation measures [10].

First step of preventing injuries and disease is hazard identification. Hazard identification allows for early identification of harmful agent risks for health and safety and also helps identify any corrective action needed. identification should be conducted by encouraging everyone involved so the information is clear and complete. These identification will help increasing people commitment to health and safety as well as the education [9] . The hazard identification represents a very important phase, since only knowing the possible hazards one can proceed with the evaluation of the efficacy of the existing preventive and protective measures.

By conducting public places identification it will also be useful to the management of public places for making decisions and keeping integrated record data. Since public places like shopping mall, swimming pool, airport, and train station provides Wi-Fi for the customer, we would like to propose hazard identification based on public places Wi-Fi login. The objective of this study is to evaluate the possibility of hazard identification to be conducted based on online log-in Wi-Fi in public places to improve people awareness about hazard surrounding them.

2. MATERIALS AND METHODS

This research used literature review on some scientific journals and data reports, and survey conducted on either local, national or international scope. We used multiple electronic databases using some keywords that related to ‘hazard identification’ ‘public Wi-Fi usage’

3. RESULTS

There is possibility of hazard identification to be conducted based on online log-in Wi-Fi in public places since our findings confirmed that there are now 3.74 billion Internet users in the world as at March 2017 compared to 3.26 billion Internet users in 2016 [12]. The statistics also tells that Wi-Fi is the preferred source for Internet

rather than mobile data [13]. Based on Wi-Fi Alliance Data as stated on Huffington Post, large amount of about 71% of all mobile communications flow over Wi-Fi and based on Wireless Broadband Association data as stated on Huffington Post by 2017, 60% of carrier network traffic will be offloaded to Wi-Fi [14].

For public places, suvey shows that most customers as in 72% of the respondents appreciate the provision of free Wi-Fi in the places they visit, as 72% of respondents. Of these, 78% said that they actively looked for and would be more likely to visit a place that offered them free Wi-Fi. Three quarters of the people surveyed who do use Wi-Fi said that they spend more time at a venue offering free Wi-Fi and two thirds suggested that they were likely to spend more money there [15].

The availability of free Wi-Fi in public places was reported as a close second improvement. A recent Kaspersky study indicated that “using public networks became the most common way used to access the Internet...”. Hotels were the second most used location for public Wi-Fi access (54%), followed by airports (38%). The ITRC survey indicated that 53% of those surveyed indicated that they used public Wi-Fi at least once a week [16].

The use of online questionnaires has exploded, given the plethora of technological advances. Online questionnaires is one of the least expensive way to reach great number of people [17]. Based on that fact, hazard identification based on online log-in Wi-Fi in public places can be optimized by using online questionnaire through redirect survey method. This method allows users to be automatically redirected to the specified web site (of your choice) to complete the survey. Steps of redirect survey method starts with user login when using public places Wi-Fi connection, then the survey will pop-up for user to answer all the questions, and the last step is user has to submit it before continue surfing the internet. Response time of this method is quick and those in charge can track respondents, non-respondents, and results throughout data collection[17].

In order to raise people awareness about public safety, before filling the survey users will be educated about how important public safety is, guideline to hazard

identification, and statement that the only way to achieve it is to involve all elements not just the government or management but including costumer.

4. DISSCUSSION

Public safety is important and lacking the awareness for it is something that we should address first before addresing other problem because effort to safety should never stop. Lacking awareness to identify hazard close to themselves is a hazard itself and being aware of it is a protective factor that can play as a barrier to prevent accident. There are resources and chances to address this problem that we should take advantage of, one of them is by using the closest technology improvement to people.

Results above shows just how fast technology can improve in one year. Resources needed in this system are gadgets and wifi availability and both of them improved both number of users and the capability itself. So the resources availability will improve as well and eventually support this system. Lifestyle changes such as the importance of communication flow or the rise of public places with WiFi, can support this system. Many people also seem to know the usage of WiFi so the education to WiFi usage is not really needed anymore and we can jump faster to the education of how to fill the hazard identification survey.

Results above also show that people are willing to go to public places and buy for them if they have access to their wifi, meaning that there is a possibility people will be willing to fill a 2 minutes survey just to get into the login page and access their wifi. So there is a possibility for governor to use the redirect survey to educate them about hazard identification and ask them to try to identify hazards surrounding them in that public places. The results of this identification can either be used for improving the bussiness and safety of the place itself or for public data that can be used to design a program by government.

The weakness of this study is that data used above is still universal, that is why to build this system the data should be studied in developing country as well so that the system can be generalized to people with the same characteristics. Practical implication of this result should be designed to people that knows the place so they

can identify the hazard correctly, for example the questionnaire pops up for people who logs in 5 times meaning that they go to that place 5 times already. Weaknesses of this study is that we dont know who access the device because it could be any other person using the same device and statement above hasn't been studied, more research needed. The improvement of wifi installation will be followed by the addition of new public places as well, so there will still be public places with no wifi that cant be reach by this system.

5. CONCLUSION

There is possibility of hazard identification to be conducted based on online log-in Wi-Fi in public places. Goverment should assess the needs to improve this system such as public places wifi installation number data and build IT division to improve the hazard identification survey and process the post-data result. However before government making this into one integrated system or post-data result to be used as occupational health and safety program or surveillance baseline data, more research or pilot project should be conducted.

Competing Interest

We have read and understood the ICOHS policy on declaration of interests and declare that we have no competing interests

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Relationship Between Physical Activity During Work and Risk of Obesity Among the Administration Staff of University X

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Abstract

Obesity is a state of body fat excessive accumulation. Its cause is highly complex, one of which is sedentary work. Obesity is a risk factor for degenerative diseases such as hypertension, heart disease and diabetes mellitus. WHO stated 2.8 million adults die each year due to obesity. Based on 2013 RISKESDAS, the prevalence of adult population in Indonesia with obesity was 15.4%. This study aimed to discover the relationship between physical activity during work and risk of obesity among the administration staff in university X, using cross sectional research method on 50 respondents. The dependent variable was physical activity during work and the independent variable was obesity risk. Determination of nutritional status carried out using anthropometric method with BMI measurement, the respondent categorized as obese if IMT ≥ 25. Chi-Square test used as data analysis method. Result showed that the prevalence of obesity was 42%, most of them (68%) had light activity and there was a significant relationship between physical activity during work and risk of obesity (p value = 0,001). Staffs who had light work activities were at risk of obesity. To reduce the occurrence of obesity, it was suggested that sports activities should be carried out outside working hours. Further research using multivariate analysis was planned to explore other obesity risk factors of these groups.

Keywords: Occupational Health, Sedentary Work, Nutritional Status, Obesity

1. INTRODUCTION

Obesity has currently become global health issue, within a decade its prevalence increased. Obesity is risk factor of degenerative diseases such as hypertension, heart disease and diabetes mellitus [1]. In 2008 World Health Organization (WHO) stated that more than 1.4 billion adult aged more than 20 years had excessive body weight and at least 2.8 million adult died every year due to obesity [2]. Meanwhile in Indonesia according to 2013 RISKESDAS, obeisity prevalence among adults was 15,4% [3].

Obesity is a condition of excessive body fat accumulation. Basic mechanism of obesity is calories intake that exceed its usage to maintain and health recovery (WHO). This condition lasts for a long time. Such excess would be stored in fat tissue which cause obesity in the long run [4]. Excessive energy intake, low energy usage in physical activity form, or combination of both conditions cause energy imbalance that lead into body weight increase [5].

Obesity diagnosis could be made through direct nutritional status assessment, used anthropometric method. One of anthropometric method used in diagnosing obesity is Body Mass Index (BMI) measurement, in which individual with BMI more than 25 [6].

Obesity cause is very complex, one of them is caused by low activity where body mechanism do not optimally occur so that energy would be stored in fat tissue [5]. Everyone could suffer from obesity if they were unable to maintain eating pattern and perform sufficient exercise, obesity commonly suffered by individual with sedentary work such as administrative or office work. Low activity work cause reduced physical activity, making this kind of work at risk of obesity.

According to research result [7], Civil Servants with low and moderate physical activity intense were at risk of obesity, compared with those who had high physical activity. This showed that employee with low work activity were at risk of degenerative disease caused by obesity.

Administration staff of University of X is kind of sedentary or administrative work, most of their work carried out in sitting position on facing computer and notebook.

The work activity of university employees spent an average of 5 hours per day, to sit in front of a computer desk. Almost half (45.76%) of the staff had obesity nutritional status and at risk of getting degenerative disease such as diabetes mellitus, heart attack, stroke, and others. This research aimed to discover physical activity during work, obesity prevalence and relationship between physical activity during work and obesity risk.

2. METHODS

The design was cross sectional survey, the dependent variable was obesity risk, while the independent variable was physical activity during work. The data collection was carried out simultaneously in July 2017. Population in this research were entire permanent employee of University of X amounted to 50 people. Inclusion criteria was permanent employee with minimum 2 years of service period and exclusion criteria of pregnant employee and employee with health issue or sick. This research used total sampling method and yielding 50 administration staffs of University of X [8].

Data were collected using a questionnaire focusing on physical activity at work that was adapted from all employees' physical activity during the eight hours of each day, using the respondent's memory of activities performed during the work. and making direct nutritional assessment using anthropometric with Body Mass Index (BMI) measurement. BMI measurement is an easy and simple method of discovering adult nutritional status with BMI threshold for Indonesia classified into 3 categories namely Thin with BMI < 18.5; Normal with IMT 18.5-25; and Fat or excessive body weight or obesity if BMI > 25. Body weight weighing carried out using digital scale with 0.1 kilogram accuracy and body height measurement using microtoise with 0.1 centimeter accuracy [6].

3. RESULTS

The result showed from 50 respondents most of employee at University of X had ‘light’ category of physical activity during work as of 68% and 32% in ‘moderate’ category (Table 1). It was found that 58% respondents had ‘not obesity’ BMI nutritional status and 42% with ‘obesity status’.

Table 1. Respondent Frequency Distribution Based on Physical Activity during Work

Physical Activity During Work	**n**	**%**
Light	34	68
Moderate	16	32

Table 2. Respondent Frequency Distribution Based on Nutritional Status (BMI)

Nutritional Status	n	%
Obesity	21	42
Not Obesity	29	58

Chi-Square test result revealed that there was significant relationship between dependent variable of light work activity and independent variable of obesity risk. Obesity was caused by light work activity.

Table 3. Relationship between Physical Activity during Work and Obesity Risk

Nutritional Status (BMI)	**Work Activity** Light		Moderate		**Total**		**Test**	**Nilai p**
	n	%	n	%	N	%		
Obesity	20	40	1	2	21	42	Chi Square	0,001
*Not Obesity	14	28	15	30	29	58		

*data combined for analysis

4. DISCUSSION

Using cross sectional survey design to test relationship between physical activity during work and obesity risk at administration staff of University of X, research sample used total sampling of 50 respondents. This research used physical activity during work questionnaire that was self-completed directly by respondent, and respondent nutritional status was assessed using BMI by measuring body weight and body height.

Most of physical activity carried by staff during work was light activity (68%). With this low physical activity there would be unused energy within body and stored into fat [1]. According to respondent nutritional status measurement, 42% of them had ‘obesity’ category and 58% of them were in ‘not obesity’ category. Almost half of

administration staff of University of X had obesity that would place them at risk of suffering from several degenerative diseases such as hypertension, diabetes mellitus and heart attack [9].

Chi-Square test result for two dependent variables; physical activity during work with independent variable of obesity risk, yielded significant relationship between light work activity wand obesity on University of X administration staff (p = 0.001). Light work activity would contribute in obesity, or the lighter the physical activity, the more for obesity to occur [7].

5. CONCLUCIONS

Work type of administration staff of University of X is sedentary work, with light physical activity involved in most of its work with total of 68% respondent. 42% respondent sample of University of X administration staff had 42% obesity for their nutritional status and were at risk of hypertension, diabetes mellitus, heart attack and others. *Chi-Square* analysis showed that the lighter the physical activity during work, the more respondent at risk of obesity.

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FACTORS RELATED FOR USE OF PERSONAL PROTECTIVE EQUIPMENT ON WORKER CARPENTER IN CIPUTAT DISTRICT SOUTH TANGERANG CITY BANTEN

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Abstract

Background: The furniture industry or the manufacture of frames is one of the informal sector industries that process the raw material into finished materials. The physical process of processing the raw materials to be used as furniture tends to produce pollutants such as particles of wood dust

Objective: The purpose of the research is knowing the factors related to the behavior of workers in the use of personal protective equipment at the workplace in sub district Ciputat, South Tangerang, 2016.

Method: This study use a cross sectional survey. The population in this study was 18 furniture industries and the total samples used are 60 respondents. Analysis of the data in this study is using univariate and bivariate analysis by chi-square test

Result: From the results of studies using the behavior of personal protective equipment found a significant relationship (significant) were age with p = 0,028 OR = 3.449, p = 0.005 knowledge with OR = 0.160, personal protective equipment facility with p = 0.005 OR = 12.667.

Conclusion The company provides personal protective equipment, the company needs to share the information about the importance, usefulness, and benefits of personal

protective equipment (PPE), workers must be aware of the importance of using personal protective equipment

Keywords: personal protective equipment, carpenter workers, behavior

1. INTRODUCTION

Furniture industry or syringe manufacturing is one of the informal sector industries that process wood raw materials into finished materials. The processing of raw materials to be used as furniture will produce pollution such as wood dust particles that have the potential to cause air pollution. Several studies have been conducted on occupational health and safety in the wood processing industry in Ghana showing that timber workers are exposed to various types and occupational hazards ranging from bacterial, viral and chemical infections to physical injuries and accidents [1]. Research on rustic workers at PT Borneo Melintang Buana Eksport Yogyakarta in 2008 found 81 percent had a sharp cut-and-sharp work accident 73 percent had crashed work accidents [2].

The results of research on small woodworking industry workers in Brazil found that they were exposed to poor working conditions, different situations and jobs. The risk of exposure to this hazard is directly related to health where the most common complaints appear to be related to respiratory illness and musculoskeletal problems [3]. The results of research in Dar es Salaam found almost 52% of all workers have respiratory symptoms Prevalence of respiratory symptoms was found statistically related to the level of exposure to wood dust. Home workers in small industries have a high probability of developing respiratory disease [4]. A study in the furniture industry in Tangerang Selatan found that 40.2 percent of workers had contact dermatitis [5].

Exposure or hazard risks that exist in the workplace are not always avoidable so that what can be done is to reduce them. PPE is the safest last step to be employed by workers. PPE is a set of tools used by labor to protect some or all of its body from potential hazards or workplace accidents. Workplace hazards are all things in the workplace that can hurt workers, both physically and mentally. Syringe industry that

uses wood base materials, produces a lot of wood dust from the cutting process, smoothing with sandpaper and shrinkage. The hazards arising from wood processing are respiratory tract disorders, and may even cause irritation if not promptly mitigated [6].

According to the ILO guidebook (1989), that of all occupational accidents due to unsafe conditions is estimated at 15%, while those caused by human acts are 85%. Thus the attention is to the unsafe human act as the cause of the accident. Such insecurity is caused by the lack of knowledge of the benefits of using personal protective equipment [7].

Based on data from the Central Bureau of Statistics in February 2012 the number of workers in the informal sector in Indonesia is higher than that of formal sector workers which amounted to 70.7 million people (62.71%). According to data from the Ministry of Health, the highest number of occupational accidents in Indonesia in 2011 is found in Banten province with the number of cases (9,891) and for the number of occupational diseases Banten Province has the highest in Indonesia in 2013 [8]. The epidemiological studies conducted by Osman and Pala (2009) on wood dust exposure in furniture industry in small industrial estates in Bursa Turkey found that FEV1 and FVC values of average wood workers, between both smokers and non smokers, were significantly low , although the FEV1 / FVC value is high ($p < 0.05$). Increases in FEV1 and FVC values were detected among timber workers with less than 10 years of service and exposure to wood dust at concentrations greater than mg / m3 compared with wood dust workers less than 4 mg / m3 ($p < 0.05$) [9].

According to a study conducted by Aji (2012) in the informal sector of the woodworker in the wood processing industry is a job with the cognitive characteristics that often suffer from high health complaints that as many as 54.2% of workers have health complaints of health complaints experienced by workers such as cough- cough and red eye sore 93,8%, skin itch 71,9%, and 37,5% tired worker [10].

Particles or dust produced from such wood can interfere with health, especially in the respiratory tract. Manufacture of furniture or frames in small-scale or home-

based Ciputat District of 5 industry owners says they are not full of work every day due to lack of demand, sometimes requests for sills or furniture are delivered elsewhere. PPE that is available in the workplace is rarely employed and the condition is dirty and unkempt and some industrial owners do not have and provide PPE, the incidence of work accidents that hit the workers such as hit by hard objects and wounds due to sharp objects, due to lack of awareness of workers to PPE. The use of PPE in many studies is related to the onset of respiratory disorders in workers [11], worker accidents in workers [1,12], symptoms of eye pain in workers [13]

2. METHODS

This study used cross-sectional survey design. The population in this study as many as 18 furniture and the sample used is the total sample of 60 respondents. Data analysis in this study used univariate and bivariate analysis through chi-square test

3. RESULTS

The results found that APD masks were used by 66.7% of workers in wood processing. Workers using PPE masks at most (67.5%) reasoned for knowing the benefits of using PPE, while those who did not use PPE at most (70%) reasoned because they were not accustomed to using PPE (see table 1).

Table 1 Recapitulation of masker PPE use

Masker PPE Use	**Amount**	**%**
Yes	40	66,7
No Use	20	33,3
Total	60	100,0

Reasoning use	**Amount**	**%**
All ready	1	2,5
Know the benefits of PPE use	27	67,5
Required	2	5,0
PPE reduce risk	10	25,0

Total	40	100,0

Reasoning not use	**Amount**	**%**
Not available	3	15,0
Uncomfortable	3	15,0
Not usual	14	70,0
Total	20	100,0

The result of bivariate analysis showed that the use of PPE mask correlated significantly with worker age (P value = 0,028, OR = 3,449), knowledge (P value = 0,005, OR = 0,160), and APD facility (P value = 0,005, OR = 12,667). The use of PPE masks is mostly performed by workers <34 years of age compared to workers with age ≥ 34 years, well-informed workers compared with less knowledgeable workers, and workers stating the presence of PPE facilities compared to workers stating the absence of PPE facilities. However, the use of PPE was not significantly associated with length of work (P value = 0.465), education (P value = 0.591), and experience of work accidents (P value = 0.148) (see table 2).

Table 2 Recapitulation of Bivariate Analysis

No.	**Variable**	**PPE Use**				**Total**		**P value**	**OR**
		Yes		**Not use**					
		n	**%**	**n**	**%**	**N**	**%**		
1.	Old workers	26	78,8	7	21,2	33	100	0.028	3,449
	a. < 32	14	51,9	13	48,1	27	100		
	b. ≥ 32								

2.	Working duration	22	71,0	9	29,0	31	100	0,465	
	a. < 7 years	18	62,1	11	37,9	29	100		
	b. ≥ 7 years								
3.	Education	6	75,0	2	25,0	8	100	0,591	
	a. Basic	34	65,4	18	34,6	52	100		
	b. Middle								
4.	Knowledge	21	87,5	3	12,5	24	100	0,005	
	a. Good	19	52,8	17	47,2	36	100		0,160
	b. Average								
5.	Experience with accident	13	81,3	3	18,7	16	100	0,148	
	a. Yes	27	61,4	17	38,6	44	100		
	b. No								
6.	PPE availability	16	94,1	1	5,9	17	100	0,005	
	a. Yes	24	55,8	19	44,2	43	100		12,667
	b. No								

4. DISCUSSION

Younger workers are more likely to have higher education and better knowledge of older workers. This is the reason that the results of the study found that the use of PPE masks more done by workers with younger age. The results of this study are in line

with the results of Iqbal (2014) research on workers in the Department of Metalforming PT. Dirgantara Indonesia (Persero) [14] and Saputri & Paskarini (2014) research on skeletal worker [15], but unlike Alfadri (2011), Putri and Deni (2014) studies that found no significant effect between worker age against the use of PPE [16,17].

The educational variables in this study indicate that there is no significant relationship with the behavior of PPE usage. This study is in line with research conducted by Saputri & Pascarini (2014), which shows no significant association between education and behavioral use of PPE [15], but not in line with Nurraihan (2010) [18] and Putri & Deni (2014) studies concluded there was a relationship between formal education and behavior using self-protective devices [17].

Education is a process of delivering materials or materials done by educators to the target of education in order to achieve behavioral changes. A person with a high formal education background will have a high level of knowledge and reasoning and a diverse persepy about something compared to someone with a low formal education background. In addition, education can also affect the way people think in work (Suma'mur, 1997) [19].

In contrast to education, the results of this study found a significant relationship between knowledge with the use of personal protective equipment. Knowledge is part of one of the factors that affect a behavior. This can be explained by the Notoatmodjo scheme (2003) that in acting or behaving is influenced by the level of knowledge resulting in a stimulus in action. Cognitive knowledge is a very important domain in shaping one's actions [20]. Respondents acted to use PPE because respondents have knowledge of the benefits of using PPE, so that they can avoid accidents due to work. These results are consistent with the Saputri and Paskarini studies [15] but are different from those of Alfadri [6] and Putri & Deni [17] which conclude that there is no significant effect of knowledge on the use of PPE.

Experiences in many studies have been the determinants of behavioral change, including in this study the experience of occupational accidents and occupational diseases. Nevertheless the results of this study indicate that there is no significant

relationship between work accident experience with the use of personal protective equipment. Based on further data excavations some workers who have had work accidents only mild accidents even for work-related diseases they say do not experience it. More than that the emergence of occupational diseases takes a long time.

The availability of personal protective equipment and surveillance facilities has a significant relationship with the use of personal protective equipment. Therefore, the need for planning, implementation and monitoring for the use of PPE in the informal sector. So that employees are controlled in getting the use of PPE. Green theory in Notoatmodjo (2003) states that a person's learning outcomes are a change of behavior. Behavior change is based on the change or the addition of knowledge of attitude and skill. However, this change of knowledge and attitudes is not a guarantee of behavioral change because the behavior sometimes requires material support and enabling factors [20].

5. CONCLUSION

Availability of PPE facilities has the highest chance of creating behavioral PPE usage in workers in the small furniture industry. The results of the study and discussion found that factors related to the behavior of PPE use in small furniture industry workers still show controversy where the results obtained are still always different. More serious-scale research is needed to ensure a pattern of relationships between variables related to PPE use in small furniture industries

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Evaluation of Active Fire Protection Systems in Cement Factory for Optimizing Fire Safety

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Abstract

Emergency condition like the fire can be occurring at anywhere including at industries, therefore workplace fire safety is the most important part of the industries. Industry must be well equiped with safety precautions. All the employers and employees must be aware of fire, and safety, have the knowledge of fire prevention and emergency response. The aim of this study was to evaluate the active fire protection systems in PT Semen Padang and the knowledge of employees about these systems. This study was descriptive study which conducted by document review, field observation, and in depth interviews. The standards used are Manpower Ministerial Regulation, Public Works Ministerial Decrees, and the NFPA international standards, consisting 3 elements. The results of this study indicate that 87% of the elements of management and active fire protection systems in PT Semen Padang has met the standard and only 56% of employees have good knowledge about the active fire protection systems. The element of active fire protection systems which not yet meet the requirement standards are placement of fire extinguisher, fire extinguisher use instructions, and heat detectors.

Keyword : Active Fire Protection, Cement Factory, Fire

1. INTRODUCTION

In the workplace, there are many hazards and risks, fire risk is one of most important. Fire was unleashed as a hazard for workers and communities in new and dangerous ways. In the building, it can be seen that in the event of fire starting, the occupants face two main hazards. They are the spread of fire itself and the spread of hot gases and smoke generated by the fire. Unless protection measures are effective occupants may be trapped and overcome by smoke and gases before they have received warning of the fire [1]. Fire is the process in which materials-some acting as fuel-are rapidly combined with the heat and oxygen, giving off gases as flame, which then further fuels the combination [2].

Many buildings have fire protection challenges. There are such challenges as inaccessibility by fire equipment due to height factor; stair egress and smoke stack effects; discordant fire safety management within and between different floors; re-designing and changes from initial intended use and; complex vertical utility services especially the heating ventilating and air conditioning conduits (HVCAs). As opposed to non-structural fire protection systems/methods such as training, fire drills which are undertaken during operational phases of a project etc., most of physical systems and methods are installed during building design [3].

According to statistics of CTIF (Comité Technique International de prévention at d`extinction du Feu) in 2015 showed that 3,503,425 fire cases with 18,454 civilian deaths and 44.973 injuries [4]. Afterward, in Indonesia, there were 984 cases of fire in 2011 – 2015 with hundreds of civilian deaths and injuries [5]. Most of the causes were due to the electrical short circuit.

Based on Manpower Ministerial Decrees number186/1999, the fire in the workplace are detrimental to the company, the employee, and the national development concerns. Therefore, it is necessary to have adequate fire protection equipment, fire prevention officers specially appointed to it, as well as the implementation of emergency response procedures[6]. Fire prevention efforts by providing the necessary means should be used as a program in a company's management policy with the support of all parties concerned.

PT Semen Padang is a company engaged in the manufacture of cement that has been established since 1910, is the oldest cement factory in Indonesia. Cement manufacturing process through various stages to become economically valuable production, the production stages begin with mining, milling, burning, up to packing and marketing. In the process of burning raw materials into clinker using high heat up to above 1000 ° C. PT Semen Padang recorded several times of fire, in 2015 there were 15 cases and increased in 2016 as many as 16 cases, while in 2017 June was seven cases. As a big company, PT Semen Padang constantly trying to prevent fires in addition to traumatic and material losses in large enough quantities. Therefore, the aim of this study was to evaluate the active fire protection systems and the knowledge of employees about these systems.

2. METHODS

This study was descriptive study which conducted by document review, field observation, and in depth interviews with cross sectional approach and sample of 35 employee in PT Semen Padang for 2 months. The standards used are Manpower Ministerial Regulation number 04/1980, Manpower Ministerial Regulation number 02/1983, Public Works Ministerial Decrees number 26/2008, and the NFPA international standards-NFPA 10, NFPA 14, and NFPA 72.

3. RESULTS

The results showed that majority (48%) of respondents were in the age ≤29 years old, senior high school levels (52%), working periods less than 5 years (44%), and there were respondents (36%) who never attended the training. Then, the respondents who have the good knowledge level about active fire protection systems as many as 56%.

Table 1. Frequency Distribution the Characteristics of Respondents

Characteristics of Respondents	Frequency (f)	Percentage (%)
Age Range (years)		
≤29	17	48
30-39	11	32
≥40	7	20

Characteristics of Respondents	Frequency (f)	Percentage (%)
Level of education		
Senior High School	18	52
Diploma	10	28
Bachelor	7	20
Working periods		
≤ 5 years	15	44
5 - 10 years	14	40
≥ 10 years	6	16
Fire Training		
Ever	22	64
Never	13	36
Knowledge Levels		
Good	20	56
Fair	15	44

Based on the reviews of NFPA 10 and manpower ministerial regulation number 04/1980 with condition of fire extinguisher in Indarung V, it can be seen that 75 % of elements have been met. The element which not meet yet the requirement standards were placement of the fire extinguisher and inclusion of fire extinguisher operating instructions [7][8].

TABLE 2. The Analysis on Conformity of Fire Extinguisher in Indarung V Based on NFPA 10 and Manpower Ministerial Regulation Number 04/1980

STANDARD	**Conforming**	**Non-Conforming**	**Information**
Fire extinguisher that used conforming to the type of fire	√		Fire extinguisher that used in Indarung V was a powder type
Fire extinguisher placement label	√		
Fire extinguisher placement is easy to see, to take, and to use when fire		√	There were fire extinguishers placement which not easily visible
Operating instruction of fire extinguisher		√	No operating instructioons
The maximum placement distance of each fire extinguisher is 15.25 m	√		
The seal is in good condition	√		
Fire extinguisher should not be installed in rooms which temperatures above than 49 °C and below 4 °C	√		Room temperaturs 24 – 28 °C
The inspection of fire	√		The investigation of fire

STANDARD	Conforming	Non-Conforming	Information
extinguisher is done twice in a year			extinguisher was done in every 6 months
Every fire extinguisher should be mounted hanging on the wall with the reinforcement or in the glass cabinet, and can be used easily when needed	√		
Placement of fire extinguisher is at a height of 1.2 meters from the floor		√	There were some of fire extinguisher placement was at a height of 1.4 meters from the floor
The outside of the tube should not be defective including the handle and the label should always be in good condition	√		
All of fire extinguisher tubes are red	√		
TOTAL	***75%***	***25%***	

Based on the reviews NFPA 14 and public works ministerial decrees number 26/2008 with condition hydrant in Indarung V got result that overall elements have fulfilled existing standards [9][10].

TABLE 3. The Analysis on Conformity of Hydrant in Indarung V Based on NFPA 14 and Public Works Ministerial Decrees Number 26/2008

STANDARD	Conforming	Non-Conforming	Information
The hydrant box is easy to see, to open, and to reach	√		
Hydrants are placed in an easily accessible	√		
The hydrant pillar is painted red	√		
A red building hydrant box with a white hydrant	√		
The hydrant box consists of a hose rack, hose, nozzle, and a hose valve	√		
The source of water supply for fire hydrants should be taken into account (min 30 minutes)	√		
Fire pumps and other	√		Fire pumps and other

STANDARD	Conforming	Non-Conforming	Information
electrical equipment must have a separate power outage from an emergency power source			electrical equipment have their own power supply-diesel
Should be provided the same coupling with the coupling of the fire extinguishers	√		
The placement of yard hydrand should be easily accessible by the fire truck	√		
The yard hydrant have 2 landing valve which min diameters 4 inchi (10 cm) and 3 landing valve which min diameters 6 inchi (15 cm)	√		The yard hydrant have 2 landing valve which min diameters 4 inchi (10 cm)
TOTAL	***100%***	***0%***	

Furthermore, based on the reviews NFPA 72 and manpower ministerial regulation number 02/1983 with fire alarm systems in Indarung V, it can be seen that 86% of elements have been met. The elements which were not meet yet the requirement standards was installation of heat detector and no flame detector there. The detector used in Indarung V were smoke detector and heat detector [11][12].

TABLE 4. The Analysis on Conformity of Fire Detection and Alarm Systems in Indarung V Based on NFPA 72 and Manpower Ministerial Regulation Number 02/1983

STANDARD	Conforming	Non-Conforming	Non-Applicable	Information
The manual call point is placed on the track of the exit lane with a maximum height of 1.4 meters from the floor	√			
The manual call point placement should not be susceptible to interference, not hidden, easily visible, easily accessible	√			
The manual call point is red	√			
Alarm sound frequency between 500 - 1000 Hz	√			
Sound noise level at least 65 dB	√			
The control panel should be	√			

STANDARD	Conforming	Non-Conforming	Non-Applicable	Information
able to show the origin of the fire location				
There are inspection and commisioning procedures	√			The procedure is Sistem Manajemen Semen Padang (SMSP)
The power source for a fire alarm system shall be at not less than 6 volts	√			
For each area of 46 m^2 with a ceiling height of 3 meters, mounted heat detector		√		The installation of heat detector only in certain room, room which have high fire potential, that is in trafo
In one group of detectors, no more than 40 heat detectors may be installed	√			
For each area of 92 m^2 should be installed a smoke sensing device	√			
The detector should not be installed within a distance of less than 1.5 meters from the air conditioner	√			
For each group the system should be limited to a maximum of 20 pieces of flame sensing apparatus that can protect the room			√	Non-Applicable
There is monthly maintenance of the detector	√			
TOTAL	***86%***	***7%***	***7%***	

4. DISCUSSION

The knowledge level of employees on active fire protection systems were good enough (56%). The workplace with second moderate fire hazard, all employee should have good knowledge. In 2017 June, reported that was seven cases of fire. Knowledge is a main strategy for providing fire prevention messages. According to NFPA, Fire and Life Safety (FLSE) is defined as “community fire and injury prevention programs and

designed to eliminate or mitigate situations that endanger to live, health, property or the environment" [13].

Fire Extinguishers: These are first-aid fire extinguishers which are installed in the building for emergency purposes. It is a legal requirement under Manpower Ministerial Decrees number186/1999, section 2 [2] to provide firefighting appliances includes, among others, fire extinguishers. The survey found that 75% of the fire extinguisher standard has been met. It was observed that there were two fire extinguishers placed in a not easily seen, blocked the machines at the kiln and coal mill. Based on the standards, all of the fire extinguishers should be placed in a place that is easy to see, easy to take, not blocked by other objects, then it easy to use when fire. Then, three fire extinguishers are at 1.4 meters. Placement of fire extinguisher is at a height of 1.2 meters from the floor except that CO_2 and dry chemical type that can be placed lower (not less than 15 cm from the floor). In addition, there should be operating instructions of fire extinguisher because not all employees have ability to use fire extinguisher. Only 64% of the employee who have attended the training.

Hydrant: also called a fireplug or simply a plug, is a connection point by which firefighters can tap into a water supply. It is a component of active fire protection. In the survey it was found that 100% of elements have fulfilled existing standards.

Fire detection and alarm systems: The essence of an alarm system is to detect fire and/or smoke and keep the building occupants and fire attendants alert and evacuate the buildings if the danger of fire became eminent. In the survey, it was found that 86% of elements have been met. For each room with 46m^2 area with ceiling's height, not more than 3 meters should be installed the heat detector. Installation of heat detection should not be blocked with material that blocks heat, because the detector is very sensitive. In addition the heat detector range is also limited, so the installation of heat detector must comply with those standards. In Indarung V, the installation of heat detector only in certain room which have high fire potential, that is in trafo.

5. CONCLUSIONS

In conclusion, it's noted that, although the buildings in cement factory are provided with fire protection systems and methods such as fire detection and alarm system, portable and fixed fire extinguishers, maintenance still remains wanting. A key setback to maintenance is improper or lack of implementation of the recommendation made after inspections are performed. Further, the survey showed that 87% of the elements of management and active fire protection systems in PT Semen Padang were met the standard and only 56% of employees have good knowledge about the active fire protection systems. It is necessary for the provision and improvement of management and fire protection systems that do not meet the requirements, as well as maintenance for those who already met. The element of active fire protection systems which not meet yet the requirement standards are placement of fire extinguisher, fire extinguisher use instructions, and heat detectors. The management should hold the training and workshop for increasing the knowledge of employees.

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The Emergency Response Preparedness Levels Based on Knowledge in High Rise Building

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Abstract

Among different types of occupancies, a commercial high rise building presents a greater challenge to emergency due to its complexity. This study aims to identify emergency response preparedness levels of employees based on knowledge. This study used cross-sectional with 25 participants using random sampling. The method used is interview to the employees. The result showed that 80% employees having good preparedness of emergency response because they have been given an explanation of it when safety induction. This significant correlation between knowledge to emergency response preparedness (p= 0,002; α = 0,005). It's recommended to maintain and increase the employees emergency response preparedness. Management should be conduct training or simulation of emergency response for employee. Besides that, it is also necessary to be given periodic safety induction for all employees.

Keywords: Emergency Response Preparedness, Knowledge Level, High Rise Building

1. INTRODUCTION

The advent of high-rise buildings in the 19th century marked the beginning of sophisticated human habitation borne out of the ever-increasing competing demands for limited space in cities. Couple with its ability to accommodate many operationos and people, high rise buildings/occupancies are the best alternative available to many municipal goverments in allocation of dwindling land sizes and spiraling prices experienced in many cities across the globe [1]. NFPA defines a highrise building as a building taller than than 75 ft (23 meters) in height measured from the lowest level of fire department vehicle access to the floor of the highest occupiable storey [2].

According to the National Fire Protection Association (NFPA), there are approximately 16,000 to 20,000 fires in high-rise buildings each year. This represents 2 to 4 percent of all building fires. These fires are associated with 80 to 90 civilian deaths, 800 to 900 injuries and $100 million to $200 million in direct property damage. Most of these fires take place in apartment buildings [3]. Afterward,on August 28, has been fire breaks out in South Jakarta apartment block [4].

High-rise buildings present several unique challenges not found in traditional low-rise buildings; longer egress times and distance, evacuation strategies, fire department accessibility, smoke movement and fire control [5]. The management of building occupants within high-rise buildings is a primary concern during emergencies.

Emergencies such as fires, bomb scares and earthquake present special dangers for high-rise buildings. Disaster research studies have identified organized planning as the most important element in successfully aiding victims in high-rise buildings. Because most people responding to disasters involving high-rise buildings have not had prior experience with such disasters, there is a tendency to see the situation and the response it requires as unique. The large size of the building and the number of employees or tenants within the high-rise increase the building's vulnerability when disaster strikes and present special challenges for risk managers. A coordinated emergency-response plan that identifies potential risks and outlines the best response is perhaps the most important step risk managers can take to protect the occupants of

high-rises during emergencies [3]. Emergency managers acknowledge that information flow is imperative to the success of any program. However, lack of knowledge of the receiver's access, interpretation, awareness, knowledge, and involvement indicates a failure of the system [6].

PT XYZ is the companies engaged in contractor oil and gas who has experience handle a great job related the field of business. PT XYZ located at high rise building area which occupies on floors 26 to 28 in Jakarta. Located at the high rise building which has the potential danger and risk, PT XYZ trying to protect the occupants of high-rises during emergencies. Therefore, the aim of this study was to identify emergency response preparedness levels of employees based on knowledge.

2. METHODS

This study was descriptive study with cross-sectional approach and samples of 25 participants that using random sampling. The study was conducted in PT XYZ between June and July 2014. The method used is face-to-face interview to the employee by questionnaires.

3. RESULTS

The result showed that employees who worked at PT XYZ majority (64%) is male with age 20-29 years old (64%) and workings for more than 3 years (48%). Many employees have never been participating in a training session (64%), but they have been following simulation of emergency situation (84%). Then, majority employees never had an earthquake disaster or fire incident (92%) and 8% respondents had experienced earthquake disaster. The employees knowledge levels in this study showed they have a good knowledge of emergency response preparedness (68%). Afterward, it also showed that the employees preparedness levels to face an emergency response were good (80%).

Table 1. Characteristicsof Respondents and Emergency Preparedness Outcomes (n=25)

Variables	Frekuensi (f)	Persentase (%)
Gender		
Male	16	64
Female	9	36
Age		
20-29	16	64
30-39	5	20
40-49	4	16
Working Periods		
1 year	5	20
2 years	8	32
≥ 3 years	12	48
Training		
Ever	9	36
Never	16	64
Emergency Simulation		
Ever	21	84
Never	4	16
Experience of Disaster		
Ever	2	8
Never	23	92
Knowledge		
Good	17	68
Fair	8	32
Preparedness		
Good	20	80
Fair	5	20

Majority the employees with good emergency response preparedness levels on good knowledge levels (62, 5%), be compared with employees with has a lack of knowledge (37, 5%). The statistical test between the level of knowledge to emergency response preparedness on employees in PT XYZ obtained p-value = 0,002 ($p < 0,005$), this was significant correlation between the employees knowledge levels to emergency response preparedness. Then, employees with a good knowledge have good preparedness 2,667 times higher in the face to emergency than employees with a lack of knowledge.

Tabel 2. The Correlation between Knowledge Levels to to Emergency Response Preparedness

Knowledge	Emergency Response Preparedness				Total		p *value*	OR
	Good		Fair					
	f	%	f	%	f	%		
Good	17	100	0	0	17	100		
Fair	3	37,5	5	62,5	8	100	0,002	2,667
Total	20	80	5	20	25	100		

4. DISCUSSIONS

The knowledge of employees on emergency response preparedness are good (80%). This is supported by management which is always do safety induction to employees. The difference in the level of knowledge about emergency response preparedness among the employees were influenced by several factors, which are internal and external factors. The internal factors covering educations, intelligence, jobs and age. And the external factors covering the environment, socio-cultural, information and experienced. But, it does not mean the other factors doesn't affect for the respondents knowledge levels. The another factor causing the difference of perception, assessment, response and the communication pattern on information about emergency response preparedness. These factors causes a different knowledge levels to emergency response preparedness.

There significant correlation between employees knowledge levels to emergency response preparedness. The employees with a good knowledge has good preparedness 2,667 times higher in the face to emergency than respondents with a lack of knowledge. Supported by Tanaka in Pangesti researched about preparedness and mitigation of earthquake among 361 respondents in Fukui and 190 respondents in San Fransisco. The result of the study explained that community located within the disaster prone tending to be able to apply of preparedness in their life. People who living in an area that prone to earthquakes as West Sumatra will have a better knowledge and positive attitudes about earthquake [7]. Level of emergency response preparaedness has also been found in studies undertaken elsewhere in Indonesia. FEMA reported that 57% of US citizens have emergency supplies prepared and ready

to be used solely in the case of disaster [8]. The Chines population have a much lower level of emergency preparedness (<5%) compared with US populations. Poor knowledge and attitudes towards emergency response preparedness are the major factors that have contributed to the low level of community preparedness outcomes. Effective education and exercise can help community residents recognise and identify hazards to improve their understanding about how to respond [9].

5. CONCLUSIONS

The level of emergency response preparedness in PT XYZ is good (80%), which is linked with a good knowledge towards emergency preparedness. The statistical showed that knowledge level to emergency response preparedness of the employee in PT XYZ obtained p-value = 0,002 (p <0,005). There was significant correlation between knowledge level to emergency response preparedness among the employees. Furthermore, the employee with a good knowledge has preparedness 2.667 times higher in the face to emergency than employee with lack of knowledge.

A variety of strategies should be taken to maintain and increase employee emergency response preparedness, including emergency training and exercise, simulation, and emergency day event for publicising purpose. In addition, the safety induction should not only be done when a new person is accepted as an employee or when the employee is transferred to a branch office, but it is better to do it periodically, once every year for example, to ensure that employees keep in mind the importance of preparedness in the face to emergency.

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Analysis and Improvement of Work Postures in Laboratorium: Application of The RULA Method

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Abstract

Background: Waste Water Treatment laboratory focused on testing of waste liquid water samples in manufacturing industry. Workers activity in this laboratory indicate that MSDs of repetitive tasks requiring reaching, precision gripping, awkward postures, and long standing. However, the negligence of working posture in laboratorium may cause injury or discomfort to the workers and muscoloskeletal disorders symptom (MSDs)

Purpose: The objectives of this research were to determine the working posture risk level and suggest recommendation of to improve the existing.

Methods: This research was descriptive observational with cross sectional study design. The samples workers activity of this research was selected by purposive. RULA (Rapid Upper Limb Assessment was observation method that concern on biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities and finding recommended actions for improvement the working postures. The muscoloskeletal disorders symptom(MSDs) measured by deep interview workers.

Results: The result of RULA method in this research have identified working postures in laboratorium which about 80% - 90% working postures categorize action level into category 6, that was distinctly harmful postures and corrective action should be taken as soon as possible. The action was needed to improve working postures of laboratorium workers, because still found working postures that risking for injury or MSDs. After redesign layout, make supporting tools to improve working postures. The RULA scores of the worker's working postures categorize action level improved into category 2. This category means that was normal and natural postures with no harmful effect on muscoloskeletal system (no action required).

Conclusion: Analysis and improvement of working posture provides a significant reduction in MSDs.

Keywords : rula, ergonomic, posture

1. INTRODUCTION

Musculoskeletal disorders are common in the United States. Although precise estimates are not available, most researchers agree that exposure to a combination of work place risk factors is a major contributor to these disorders. Along with personal factors (age, gender, etc.) [2,3,4]. Epidemiologic studies of workers have associated these disorders with many work-place physical and psychosocial factors. Specific physical factors associated with these disorders include intense, repeated, or sustained exertions, awkward, sustained, or extreme postures of the body, insufficient recovery time, vibration, and cold temperatures. Specific examples of work-place psychosocial factors include monotonous work, time pressure, high work load, lack of peer support, and a poor supervisor-employee relationship [5]. Upper extrimity work-related muscoloskeletal disorders symptom (MSDs) are a significant problem for employers workes in many industries. Additional possible work-related risk factors for upper extremity disordes include awkward work posture, vibration, mechanical contact strees, cold temperatures and poor fitting gloves [1].

Waste Water Treatment laboratory focused on testing of waste liquid water samples in manufacturing industry. Workers activity in this laboratory indicate that MSDs of repetitive tasks requiring reaching, precision gripping, awkward postures, and long standing. However, the negligence of working posture in laboratorium may cause injury or discomfort to the workers and muscoloskeletal disorders symptom (MSDs).

2. METHODS

This research was descriptive observational with cross sectional study design. The samples workers activity of this research was selected by purposive. RULA (Rapid Upper Limb Assessment) was observation method that concern on biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities and finding recommended actions for improvement the working. The muscoloskeletal disorders

symptom (MSDs) measured by deep interview workers.

3. RESULTS

The result of RULA method in this research have identified working postures in laboratorium which about 80% - 90% working postures categorize action level into category 6, that was distinctly harmful postures and corrective action should be taken as soon as possible. The action was needed to improve working postures of laboratorium workers, because still found working postures that risking for injury or MSDs. After redesign layout, make supporting tools to improve working postures. The RULA scores of the worker's working postures categorize action level improved into category 2. This category means that was normal and natural postures with no harmful effect on muscoloskeletal system (no action required).

4. CONLUSSIONS

Analysis and improvement of working posture provides a significant reduction in MSDs.

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COMPETING INTEREST

For this research the authors dont have any competing interest with others.

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Analysis and Improvement Of Noise Reduction In Engine Assembly Office Area

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Abstract

Background. The engine assembly area has some hazards of working environment, one of which is noise. Noise can come from engines and equipment for engine assembly, such as impact gun. Based on environmental measurement results for noise in the office area located not far from the engine area reached 88.1 dBA. The value exceeds the TLV works in 8 hours of 85 dBA, so *recommended actions or improvement* for control to reduce noise in the area of office engine assembly. **Purpose.** To reduce the noise intensity in the office engine assembly area so that within the limits of the allowed threshold value. **Methods.** *This research was experimental with cross sectional study design* by making isolation barrier between office area with production assembly engine area. **Results.** Measurement of exposure of noise to workers is done for 2 days in the office engine assembly area with time every day 8 hours according to working hours. Obtained results Leq / Lavq 93,3 dBA. Then conducted a study to determine the form of noise reduction that will be done. Some analysis: 1. No barrier for noise exposure. 2. Close distance between office area and production assembly engine area.Improvement for this case are making isolation barrier as noise reduction form between office and production area. The result is noise decreased to 58.3 dBA and its accordance with the TLV and worker allowed to work for 8 hours. **Conclusion.** Redesign office station with Isolation barrier can be done and is quite effective as noise reduction for work environment with noise hazard above threshold value.

Keywords: hazard, noise, threshold value, assembly

1. INTRODUCTION

During the last 20 years, manufacturers of machine tools have developed new technical solutions, such as high-speed machine tools, or increased of mechanization, leading to great productivity improvements and reduction of labour costs. Machines and tools was used to support the production process have the potential effect to cause noise. Noise is the unwanted sound that interfere and endanger health. In recent years, environment impact has become an additional challenge . An additional challenge is to limit the Occupational Health and Safety problems (OHS) impact of manufacturing plants on operators. Among the aggressions undergone by operators in a engine Assembly area, noise is a critical hazard since it affects them daily without any obvious short-term impact on hearing

The general effect of noise on the hearing of workers has been debate among issue for a number of years. Noise-induced hearing loss is the most general effect of noise. Noise-induced hearing loss is second most common form of sensorineural hearing deficit, after prescbycusis (age-related hearing loss). Hearing forces caused by any sound have an impact on the stereocilia of the hair cells of the basilar membrane of the cochlea; when excessive, these forces can cause cell death. Avoiding noise exposure stops further progression of the damage. Noise-induced hearing loss can be prevented by avoiding excessive noise and using Hearing Protection Devices (HPD) such as earplugs and earmuffs.

OSHA has define standard common source of noise and mandates that employers provide hearing conservation programs for their employees in workplaces where noise levels equal or exceed 85 dB(A) for an eight-hour time-weighted average. An occupational hearing conservation program includes engineering and administrative controls to reduce noise exposures, employee training in the use of hearing protection and annual audiometry for all workers who are exposed to noise.

The Indonesian Regulation (Permenakertrans No. 13 Tahun 2011) indicates daily noise exposure levels for 8 working hours: (i) below 85 dBA, no protection is recommended, (ii) over 85 dBA, protection is necessary and the company must initiate a program to reduce noise emission. Between 80 and 85 dBA, the company must offer

individual protection to the operators and to test their hearing capacity annually. The critical daily noise exposure level of 85 dBA is often exceeded in the manufacturing industry [1,3].

As a consequence, technological advancements are needed to reduce the noise intensity in the office engine assembly area so that within the limits of the allowed threshold value.

2. METHODS

This research was experimental with cross sectional study design. Step tof this research is assessing the noise-level or sound pressure level in engine assembly area, and exposure of noise received by workers, evaluate and control the noise levels workers are exposed to facilitate a mitigation of the high dose of noise that constitute not only a potential risk to hearing. And the experimental of this research is reduce the noise intensity in the office engine assembly area.

3. RESULTS

To assess the exposure of noise received by workers directly in the Engine Assembly Office area. Measurements were made for 2 days on the workers in the Engine Assembly Office area, measurements using the dosemeter noise tool ± 8 working hours in accordance with actual working hours in the Office area. Measurement of exposure of noise to workers is done for 2 days in the Engine Assembly Office area with time every day 8 hours according to working hours. Obtained results Leq / Lavq 93,3 dBA. Based on the results of noise dosemeter measurements on both employees have relatively high noise levels and exceed the allowed limits> 85 dBA, so it is necessary to control to reduce noise exposure on employees who work in the area.

Analysis of engine assembly area condition conducted to know what that should be control to reduce noise exposure. Some analysis No barrier for noise exposure from all off machine in engine area. And close distance between (3 meters) office area and machine in engine area. Improvement for this case are making isolation barrier as noise reduction form between office and production area.

Reduce noise exposure on employees who work in the area in this study by redesign office area with make a bulkhead from gypsum material. After redesign office area have been done, measurement of noise exposed or sound pressure level result is noise decreased to 58.3 dBA and its accordance with the TLV and worker allowed to work for 8 hours.

4. CONCLUCIONS

As the engine assembly industry pay serious attention to noise levels, and their impact on occupational health and safety, we need to assessing the noise-level or sound pressure level in engine assembly area, and exposure of noise received by workers, evaluate and control the noise levels workers are exposed to facilitate a mitigation of the high dose of noise that constitute not only a potential risk to hearing. Redesign office station with Isolation barrier can be done and is quite effective as noise reduction for work environment with noise hazard above threshold value.

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Competing interest

For this research the authors dont have any competing interest with others.

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The Importance of Hospital Safety in Indonesia

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Abstract

Based on geographical, geological , hydrological and demographic , Indonesia has a severe impact on the occurrence of disasters , whether caused by natural factors , non - natural factors and human factors . Hospitals are expected to function as a safe environment during disasters, but many become unusable because of structural and nonstructural damage. Making hospitals safe in the event of disasters is a major concern. However, measuring a hospital's safety has been difficult. Such an assessment would increase hospital safety by identifying and prioritizing essential safety interventions. **The aim was to develop a comprehensive framework of Hospital Safety**. The framework was developed using literature study, and discussion with academic experts. Searches were conducted of the commonly used health databases to identify relevant literature and reports. Search terms included ' framework or model' or 'evaluation or assess or measure and hospital and disaster or emergency or mass casualty and resilience or capacity or preparedness or response or safety'. Articles were retrieved that focused on disaster preparedness frameworks. An article publications were retrieved initially but the final analysis was conducted on limited articles, which appeared to contribute to the study objectives. Nine disaster preparedness frameworks and many evaluation instruments of hospital disaster capacity were included. **Hospital Safety is a comprehensive concepts derived from existing disaster preparedness. Hospital can use instrument such as Hospital safety Index from WHO to assess hospital disaster preparedness. Disaster resilient hospitals must be able to protect the lives of patients and staff and continue to function. Hospitals need to ensure structural safety, non-structural safety and disaster management.** Safe hospitals have symbolic social value; losing a health facility leads to

a sense of insecurity and social/ political instability. A conceptual understanding of hospital safety is essential for an intellectual basis for an integrated approach to system development.

Keywords: Hospital safety, disaster, framework

1. INTRODUCTION

Hospitals are highly complex facilities that play a vital role in the medical response to disasters. They are the symbol of faith and hope for the entire community during such tragic events. However, they are susceptible to the impact of disasters with respect to their structural, non-structural and functional elements. Many hospitals have collapsed or been damaged and rendered non- functional as a consequence of disaster. The resilience of a hospital along with the capability of effective medical response to disasters is a key part of any disaster plan. Hence, the most crucial element that needs to be ensured with every emergency is that health facilities should not be casualties. More lives can be saved if the hospitals and health facilities sustain its functionality during and in the aftermath of an event [1].

Disaster is defined as a resource imbalance during an incident [2]. Hospitals need to uphold normal functions during a disaster [3]. However, studies of previous disasters have shown that hospitals located in disaster areas are not well prepared and usually become inoperative either as the result of direct damage or functional collapse [2,3,4]. Confusion over roles and responsibilities, poor communication, lack of planning, suboptimal training, and a lack of hospital integration into community disaster planning can lead to unprepared hospitals [2,5].

Hospital preparedness is part of the disaster plan and should build on a standardized protocol. Checklists and other evaluation tools should be incorporated into the hospital disaster plan in order to recognize possible gaps and weaknesses [6] Several hospital disaster preparedness evaluation methods have been created [2,3,6,7]. However, no consensus exists on a standardized, comprehensive and reliable tool with which to measure hospital preparedness [6].

The aim of the current study was to perform a literature review to develop a comprehensive framework of Hospital Safety.

2. METHODS

The framework was developed using literature study, and discussion with

academic experts. Searches were conducted of the commonly used health databases to identify relevant literature and reports. Search terms included ' framework or model' or 'evaluation or assess or measure and hospital and disaster or emergency or mass casualty and resilience or capacity or preparedness or response or safety'. Articles were retrieved that focused on disaster preparedness frameworks.

3. RESULTS

Hospitals are vulnerable to all kinds of natural and man made disasters. Those hazards which while affecting the community has equal chance to cause damage or destruction to the hospital or can cause overwhelming effect due to mass casualty scenario are termed as external disasters. Internal disasters are primarily those where the hospital becomes a victim due to cause from within the hospitals such as fire hazards, building collapse, etc. In view of the diverse nature of hazards affecting hospitals, it becomes essential to adopt an 'All Hazard approach' while addressing safety issues and developing preparedness plan for the hospitals [8].

A safe hospital should not collapse in disasters and cause casualties of patients and staff, but should continue to function and provide services as a critical facility for the community when it is most needed. A hospital should be equipped with contingency plans and have an operational network in place [8].

Hospitals are considered an important lifeline structure for communities. Keeping hospitals functional and operational during disasters has been challenging. The following goals are envisaged for hospital safety: 1) Ensure structural and nonstructural (*building and arrangement*) resilience of hospitals ; 2) Ensure functionality (*management*); 3) Enhance capacity of *human resources* [1,2]. The point number 3 still need collaboration with communities.

Developing the conceptual framework of 'hospital safety' would provide a starting point for hospital, government and another stakeholder about what comprises hospital core capacity in the context of disasters, and would also assist in integrating this broad range of capacities together into a comprehensive whole view. By adapting

the hospital safety index from WHO, it is hoped that this new conceptual framework for health will be consistent and an approach that promotes the integration of hospitals within the community.

4. CONCLUCIONS

Hospitals are essential lifeline of every community and are symbols of faith and belief during any emergency or disaster event. Any harm to their structure or functions can lead to disruption of operations of essential services thereby causing loss of lives as well as loss of faith among the community members. Apart from the health and sociocultural impact, the huge economic loss due to destruction of a facility can significantly affect the reestablishment efforts and rebuilding of the community confidence. The hospital safety mainly comprises of structural, non-structural, functional capacity ad human resources. In order to ensure safety of hospitals, there is a need to develop an action plan which includes assessment of vulnerability, hazard mapping and preparedness plan with adequate backup resources.

Hospital Safety is a comprehensive concepts derived from existing disaster preparedness. Hospital can use instrument such as Hospital safety Index from WHO to assess hospital disaster preparedness. Disaster resilient hospitals must be able to protect the lives of patients and staff and continue to function. Hospitals need to ensure structural safety, non-structural safety and disaster management [9].

Governments are in a position to provide leadership but it takes collaboration among public and private health care sectors, and individual hospitals and hospital groups to protect and care for populations affected by disasters. Improving preparedness of hospitals is a global need.

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Competing interst

None

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SAFETY BEHAVIOR DESCRIPTION IN GEOENGINEERING DIVISION PT FREEPORT INDONESIA 2016

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Abstract

The high number of accident in PT Freeport Indonesia, push management looking for prevention alternative which effectively and efficient to avoid accident in the future. Offered alternative by management is the implementation of Safety Behavior Program in all division of PT Freeport Indonesia. The reason is according to H.W Heinrich theory which stated that the most accident causes is related to Unsafe Act (88%).

GeoEngineering Division carried out survey about safety behavior to all level of employee, from pratama level to management level. Safety behavior analyzed related with knowledge & competence, communication, awareness & attitude, responsibility, supervisory, management commitment and legal compliance.

Result of analysis show that pratama, muda-madya, and management level still not good enough in knowledge and competence and it is need to improve by giving a suitable training. Afterward, for responsibility element for pratama level also need to be improved and its related with responsibility to Occupational Health and Safety. Improvement of effective communication at muda-madya level still need to increase either for supervisor and subordinate and vise versa, and it is expected Occupational Health & Safety perform well if the communication also running well. Survey result at the management level related to management commitment, legal compliance, communication, awarensess & attitude, responsibility and supervisory has been good.

Keywords: Safety Behavior, Level, Survey, Occupational Health & Safety

1. INTRODUCTION

Background

In 2016, PT Freeport Indonesia has state that all division under PT Freeport Indonesia obligate to implement safety behavior program. Those based on the highest of accident number on previous year. In 2015, there were some accident which causing a huge loss from time side, day lost, property damage, accident caused fatality, major injury, compensation that must be payed, etc. From the data which obtained from Senior Staff Meeting of PT Freeport Indonesia, noted that in 2015 there were some incident as following.

a. Fatality event as many as two cases on January and July 2015.
b. Accident case which caused lost day (LT/RD) as many as 34 cases. In average, there was 2.8 times LT/RD every month.
c. Recordabel injury during 2015 as many as 90 cases, which means every month there was recordable injury 7.5 times.

Until June 2016, accidents noted as follows:

a. Fatality event happened one time until June 2016
b. Accident which caused day lost and restricted duty (LT/RD) as many as 20 cases. Which means the average of accident until June 3.3 times.
c. While for recordable injury until June 2016 was 55 cases, and the average was 3.3 times every month [4].

From the data above concluded that, there was so many lost of PT Freeport Indonesia caused by accident. As mention at the beginning that all division obligate to implement safety behavior program in all division to decrease or eliminate accident. According to PTFI principal which stated on OHS policy, that all accident can be prevent in many ways, one of them is safety behavior implementation.

For GeoEngineering Division, it is recorded there were 51 cases during 2015, and total loss was USD 6018,17. That lost is direct cost such as recovery cost, medical cost, etc. While for loss time, administration, working time was not count on that cost. Till July 2016 in GeoEngineering

Division has occured 30 cases and cost around USD 6742,58. those cost was for recovery of broken property and also cost for fine because traffic violation [3].

From accident analysis result 2015 using *Human Factor Analysis and Classification System* (HFACS) method it is known that the most dominant causes of accident is that employee did not conduct hazard identification and risk assessment prior to work. Moreover, lack of supervisory when conducting a job become the additional causes and break the procedure. From those result, known that human factor become the main cause of accident in GeoEngineering Division. This is in line with H.W Heinrich theory which stated that 88% of accident caused by unsafe act.

Human behavior directly effects to all aspect of life, include to the work conducted. Human behavior is associate with behaviour, personality, motivation, memory, together with environment forming the physical and mental characterictics of human [1].

Regarding to chairman direction of PT Freeport Indonesia, GeoEngineering division create a Safety behavior program which aim to minimize or even to eliminate accident in GeoEngineering division. On this cases GeoEngineering create and conduct a survey related to employee behavior observation and distribute to all level. The questions on the survey related with safety behavior components such as *knowledge and competence*, *communication, awareness and attitude, responsibility, supervisory, management commitment,* dan *legal compliance* [5].

Objective

The purpose of this survey are:

a. To know the description related with safety behavior components such as *knowledge and competence*, *communication, awareness and attitude, responsibility, supervisory, management commitment,* dan *legal compliance* to each level of employee.
b. To see the lack of each components of safety behavior in each level of employee, in order the right improvement implemented.

c. To know the goodness of each safety behavior factor on each level, in order to defend and even increased.

Problem

The reason of this survey conducted are:

a. The accident occurrence in GeoEngineering 2015 and 2016 still high
b. Human factor become the most causes in GeoEngineering Division

TEORITICAL REVIEW

Human behavior have directly effect to safety, either when on site, at home, on road, on air and also on sea. Evidence said that previous cases such Flixborough, Kegworth dan Moorgate and also Piper Alpha, known that on those accident human factor contribute significantly. Behavior definition by Jeremy Stranks, 2007 as follows [1].:

- How someone treat him/herself
- Behavior and act of someone
- Behavior observed

Human behavior is associated with act, personality, motivation, memory together forming physical and mental characteristics with environment. Human acts differently, everyone have form and pattern of behavior based on condition and situation. Behavior aspects is associated with many physicological factor which contributed to how people act include motivation, memory, personality and perception. In addition, individual factors such the way of educate, the past, environment, level of knowledge and understanding, emotion, stress, has a big effects to individual behavior [5].

Safety Culture

The strong development of Occupational Health and Safety (OHS) has a strong impacts to the decrease of accident and occupational diseases. Those must be the first priority of manager in all level. One of safety culture definition which suggested by HSC is that safety culture form an

organization is a product which come from individual or group value, behavior, competence and behavior pattern which consider committment to the style and and performance from an Occupational Health and Safety (OHS) in organization. Organization woth safety culture is the characteristics of communication which built based on trust each other, sharing perception about the importance of safety, belief of the importance of prevention act.

Safety culture of an organization is the result of some factors as follows:

- Norm, assumption and belief from director, manager and employee
- Behave to all level in organization
- Policy and procedure
- Priority of supervisor, responsibility and accountability
- Action or lack of action by management to improve unsafe behavior
- Production and low level compare with quality issue
- Training and motivation of employee
- Involvement of employee and consultation

Culture Factor

Occupational and Health Safety culture from an organization is associated with many factors as follow:

- Knowledge and Competence of Individu

  Knowledge and competence of all employee must be suitable to the condition of hazards and risk which are in workplace. This is must be related with training and instruction of personel and also self education from him/herself.
- Management Commitment

  Management is required to be able to show the committment as an approach to adopt the purpose of safety.
- Compliance to Law Requirement

There must be adequate knowledge related with law and regulation and personel must have motivation to obey that regulation. This can be built together objection in a system such as reward and punishment.

- *Individual Awareness*

  An employee must be aware and care to the importance of safety through information, instruction and training which supported by giving regular supervisory.

- Supervisory

  Management shall supervise the work individually, include conduct review to the procedure.

- Responsibility

  Responsibility of individu to safety and occupational health must be noted clearly and understood.

When there is a strong Occupational Health and Safety culture in an organization, all employee would feel receive a responsibility to OHS and the will conduct it consistently. Perhaps an individu will conduct beyond the expectation that burdened to them to identify unsafe act, behavior and condition, carry out something for safety. For example an employee will glad to warn a senior staff whose visit to wear PPE during their visit in the field. This behavior should not be perceived as something “over-jealous” but its something that need to be respected by organization.

A strong Occupational Health and Safety culture in an organization has a little behavior at risk. And the result is, low of accident number, low of employee turno ver, low of absenteism and high prodctivity. Generally, Company will show a good performance in the market.

One of the key success om safety culture implementation is the involvement of senior or chairman of the Company such director, senior manager. By support of the chairman it is expected the good of performance, either for OHS and also for production **[**5**].**

2. METHOD

Data obtained from the survey by distribute questionnaire to all level of employee in Geoengineering Division. The level was devided in to Pratama, muda-madya and management level. The number of questionnaire distributed is 281 questionnaires. Questionnaire back as many as 241. More over, this survey was just to see the description of safety behavior of OHS and not for seeing the correlation between surveyed factor with safety behavior.

Data Management

Survey data is manage by grouping th questions and divide in several part such as:

- *Knowledge & Competency*
- *Communication*
- *Awareness and Attitude*
- *Responsibility*
- *Supervisory*
- *Management Committment*
- *Legal Compliance*

The weight of each questions is grouping into 4 parts start form 1 to 4. The meaning of the number is as follow:

1. 1: *Poor*
2. 2: *Enough*
3. 3: *Good*
4. 4: *Very Good*

STRENGHT AND WEAKNESS OF THE SURVEY

a. Strenght
    - This survey can see the described of every elemen in safety culture and safety behavior in GeoEngineering Division.

- The questions in the survey is related to OHS program which are in GeoEngineering division, so the result is expected suit with the real condition.
- This survey include all level of employee where all the question was adjust by level, in order the result expected more objective and comprehensive.

b. Weakness

- This survey is not determine the level of safety culture as Du Pont theory
- This survey is need the high honesty, and then if responder not answer honestly, the result must be not good.
- This survey is not seeing the association between the safety behavior elements with GeoEngineering Division accident and need further assessment to see that association.

3. RFESULT AND SURVEY ANALYSIS

Below is the result and survey analysis of behavior safety, which has been conducted by GeoEngineering Division 2016.

a. Pratama Level

1) Knowledge & Competence

Below here is the analysis and survey result for Pratama level

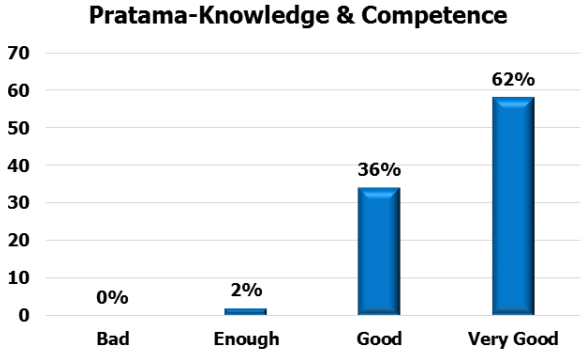


Fig 1: Graph of Knowledge & Competence on Pratama level

From the survey result analysis which conducted to 94 responders on Pratama level, known that 2% between them still classified to “enough” category, 36% “good” and 62% “very good”

Two percents (2%) from the total 94 responders of pratama still classified to poor enough in terms of knowledge and competence. According to the survey, those things caused by Pratama employee only had supervisory when conducting a job.

Jeremy Stranks, 2007 said that there is correlation between skill and accident especially things related with time reaction, uncapable of someone to coordinate with working aspect they conduct. Factor that affects individual capability in relation with accident such as reaction time, coordination and attention.

2) Communication

From the survey result related to communication on Pratama level, known that 17% classified “good”, 83% “very good”. Generally, communication system between employee performed well. But in some cases, there was a bad communication, between the crew or even crew with their supervisor. Failure communication can lead to unsafe act that cause accident. Lack of communication is a factor which contributed in an accident [1].

Graph below shown the communication on pratama level.

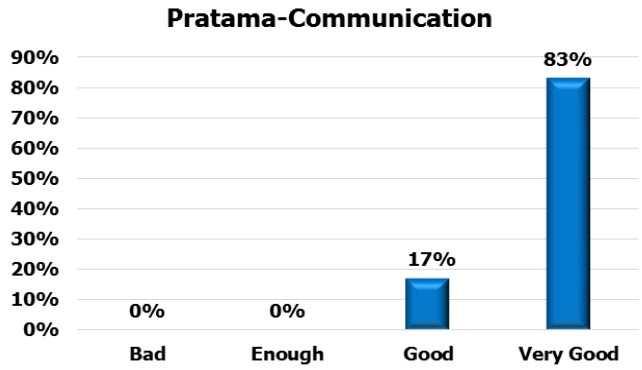


Fig 2: Graph of *Communication* on Pratama level

3) Awareness & Attitude

Awareness & attitude component which obtained from the safety behavior survey result, known that 15% from the total responders had a good awareness & attitude and the rest 85% had a very good. Eventhough data from survey result showed a good and very good for awareness & attitude component, it was still found that employee did not perform well 5 steps to safety, some employee also didn't aware of passengers safety where they did not remind them to wear safety belt while driving, did not conduct precheck operation well, often to horse play, did not follow up inspection result, did not obey the procedure and did shortcut.

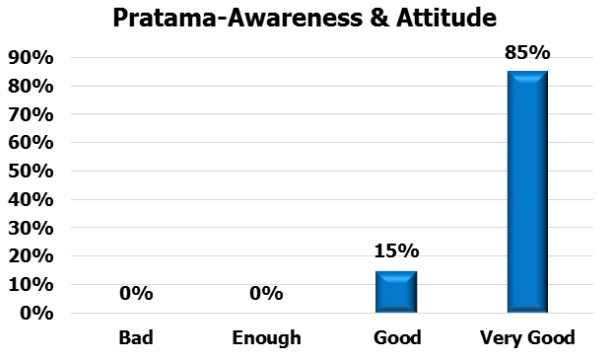


Fig 3: Grpah of Awareness & Attitude on level pratama

It is a very difficult to change someone behavior. Someone who had a bad behavior can changes to be good. But if a stimulus given such pressure, that attidute can go back to the beginning attitude that is "not good" [5].

4) Responsibility

From responsibility side to occupational health and safety, it is known the result that two percents (2%) from total responders classified responsibility "enough" in doing

their job, 16% fell ”good” and 81% feel ”very good”. In this case an employee not only responsible to their self but also to another people, equipment, PPE which given by company. From the survey analysis its been known there are still some employee who only cares for them self, did not keep PPE and equipment which given to them.

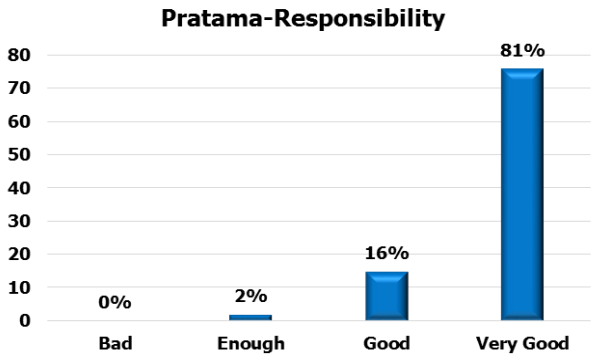


Fig 4: Graph of *Responsibility* on pratama level

All employee responsible to the OHS. All the people must keep their safety and other people. Responsibiltiy to safety is an obligation of employee in all level. The higher position of someone, it is expected that responsibility to safety also high, means that able to supervise and keep the safety of employee under him/her. But the main of these all is, that all level must keep their safety, other people and also the assests which given by company to them [1].

b. Muda,Madya Level (Level 1-3)

1) Knowledge & Competence

On knowledge & competence component at muda, madya level known that survey result where 5% from total responder feel that knowledge and competence still ”bad”, 66% enoguh, 17% good and 12% very good.

Muda, madya level feel that training given not enough to fulfill their competence especially in OHS. Around 71% responder Muda, Madya said that training given is

enough, but still not able to fulfill their knowledge and competence in OHS. As a supervisor who have many subordinate, expected to have an adequate competence to direct their subordinate especially in OHS. How can a supervisor who has not adequate knowledge and competence can direct and control their subordinate well? The answer is supervisor must be completed with training, education, direction, guidance in order to be able to become a role model and able to direct their subordinate correctly. A supervisor has an importance role in OHS. Below are the things that supervisor must have:

- *Introduction*: supervisor shoud know their subordinate who become their responsibility and vise versa.
- *Instruction*: supervisor delivered information and theory with a good behavior refer to safe working system, know how to wear PPE correctly, know the procedure of incident reporting system, etc.
- *Demonstration*: supervisor must be able to show how to do a job safely.
- *Monitoring*: monitor and measure the capability of their employee include the obeying of safety procedure.
- *Reporting*: create fair evaluation to employee.
- *Correcting & encouraging* : correction and empowering employee.

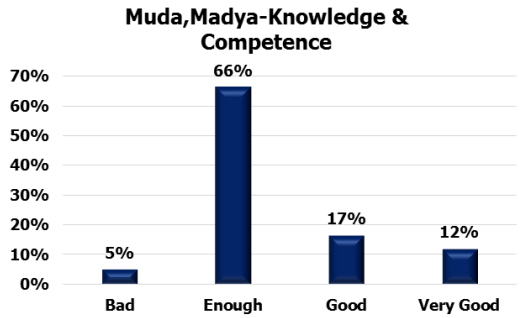


Fig 1: Graph *Knowledge & Competence* on Muda-Madya level

All above factor must be considered while giving a training to a supervisor where it becomes their responsibility in doing a job to ensure the OHS of their subordinate running well.S **[**5**].**

2) Communication

In communication component obtained survey result 5% from the total responder feel that their communication classified ”enough”, 48% ”good” and 47% classified very good.

Observation result show that there was still supervisor who did not communicate with area owner when conducting work in certain area. Moreover, hazard and risk of the job was very seldom communicate in the team, top risk, HIRADC, golden rules either. Also, there were some supervisor reluctant to remind their subordinate who carried out unsafe act cause they are older and more experiences.

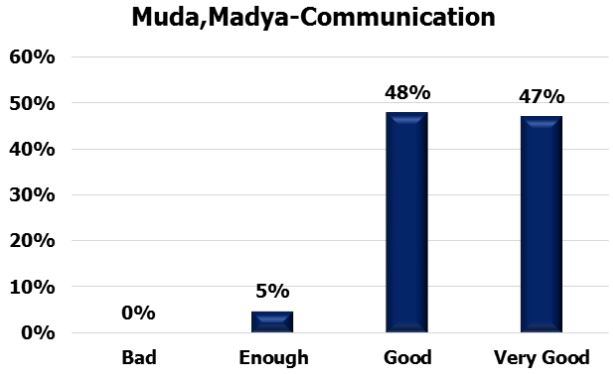


Fig 2: Graph of *Communication* on Muda-Madya level

A good communication either from supervisor to subordinate and vise versa, will cultivate high responsibility. Positive communication will increase positive relation in a team [1].

3) Awareness & Attitude

Observation result shows that *awareness & attitude* on muda, madya level is classified good. From all responder muda, madya level it's been known that 10% of them feel that their awareness and attitude was classified "good" and 90% classified "very good".

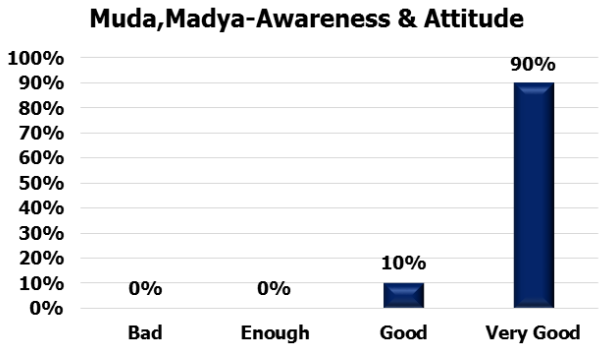


Fig 3: Graph *Awarenss & Attitude for* Muda-Madya level

A good behavior from supervisor is an effective example for their subordinate to change negative behavior to be positive. If supervisor have a bad attitude, automatically their subordinate will follow and not respect to their supervisor. However, if supervisor have and give a good example, their subordinate will follow dan respect them [1].

4) Responsibility

From observation analysis know that muda, madya level have a good responsibility, either their job and subordinate. From all responder known that 39% have a "good" responsibility and 63% classified as "very good". This things is become a positive thing, cause supervisor have adequate responsibility for subordinate and their job.

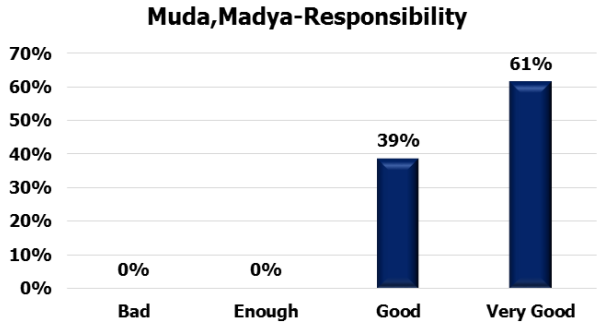


Fig 4: Graph *Responsibility for* Muda-Madya level

Responsibility is one of the biggest burden. Safety responsibility is one of obligation to do a job which given to him/her successfully without loss and accident. Responsibility become authority should be able to direct and take action to ensure a success. Safety responsibility is also an obligation to believe the leader, to maintain well, care, safety property or funding or supervisory of individu or team **[**1**].**

5) Supervisory

From the survey result about supervisory its been known that 1% from the total responder have a bad supervisory, 13% classified enough , 11% good and 75% “very good.

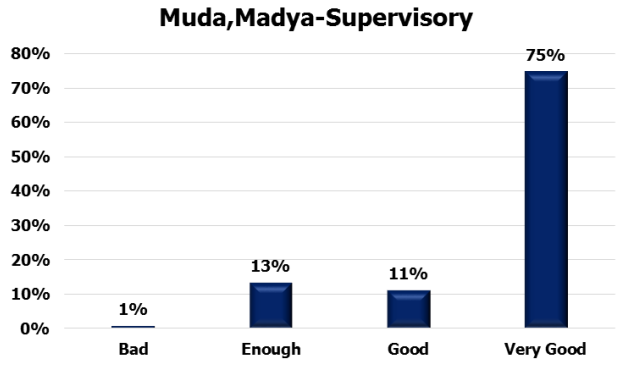


Fig 5: Graph of *Supervisory* for Muda-Madya level

Adequate supervisory will be able to decrease the effect of incident occurrence. A supervisor should have capability, good behavior, knowledge, experiences,

leadership and also adequate capability of communication, in order able to direct their subordinate correctly. If a supervisor have no components above, then the leaning of an individu to have violation will getting high.

c. Management Level (Level 4 Up)

1) Knowledge & Competence

Observation result which conducted to management level, for knowledge & competence known that 5% from the total of responder said that their knowledge and competence is “enough”, and 15% classified “good” and 80% “very good”.

If we have a look from observation result, there were still management level whose feeel that their knowledge and competence was not enough, so it is needed to have an adequate training. There were employee said that safety program was only the responsibility of SHE Reps and FSO area.

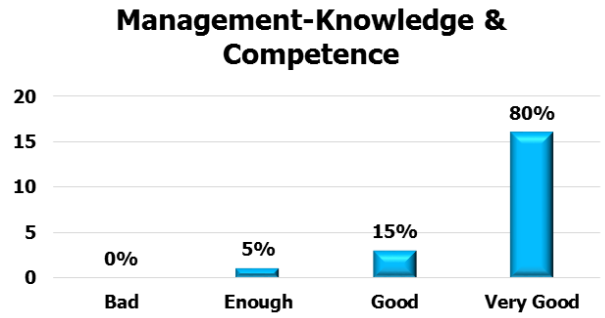


Fig 1: Graph of *Knowledge & Competence* for management level

Leadership need adequate ability such for decision making, delegating a person, adequate persuasive, good communication, able to motivate other employee and empowering their subordinate by knowledge and good capability **[**5**].** It can be conclude that without knowledge and capability of a leader, an organization will running difficult.

2) Communication

A good communication, between supervisor and subordinate and vise versa become the most important in an organization. From observation result on management level for communication component, it's been known that 5% from the total responder said that their communication was good and 95% is very good.

Effective communication is one of the important thing in implementation of occupational health and safety. Lack of communication usually contribute to accident. The barrier in effective communication should be solve out by increasing effective communication. Follow is the description related to communication on management level.

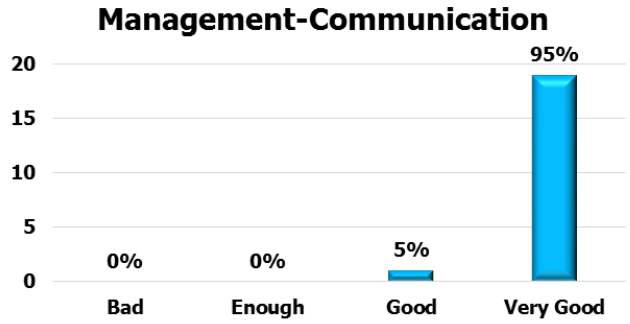


Fig 2: Graph of *Communication* on management level

3) Awareness & Attitude

From observation result related with awareness & attitude known that 5% from the total of responder said that their awareness and attitude was good and the rest 95% said that they have a very good awareness and attitude.

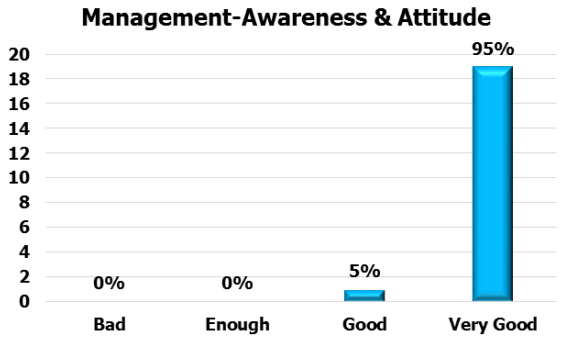


Fig 3: Graph of *Awareness & Attitude* for management level

A good safety behavior is an important element in safety culture, where to reach all level in organization must be trained. A good example of safety behavior, which conducted by management level, is a best example for their subordinate and colleagues [6]. Through survey obtained above by management level was good and very good, and need to keep or even increased to reach better safety performance.

4) Responsibility

In *responsibility*, survey result been known that 15% from the total responder of management level said that in term of responsibility, it has already good and 85% classified ”very good”. Responsibility on this things is associated with occupational safety and health. All question related with responsibility related with the responsibility of management in each department.

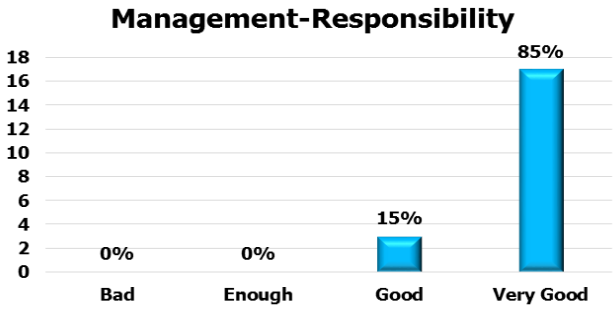
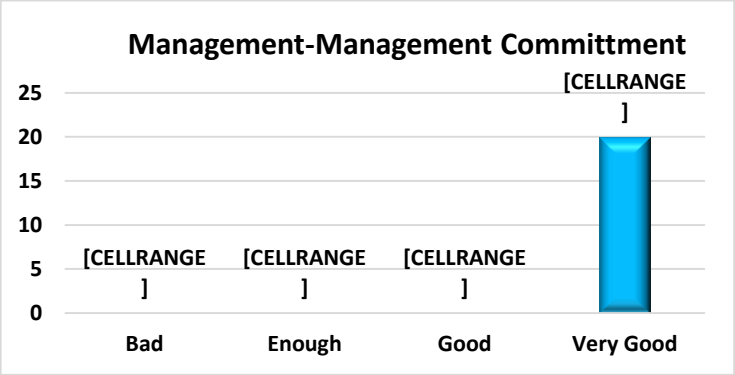


Fig 4: Graph of *Responsibility* for management level

The highest position of someone in an organization, the responsibility to occupational health safety also highest [1].

5) Management Committment

Survey result related with *management commitment* known that 100% responder of management level have a very good commitment to occupation al health and safety. This result hopefully implemented in real by management level to increase the quality of OHS, especially in their own department.



Gambar 5: Graph of *management commitment* for management level

The involvement of management in OHS program is not enough. Fully commitment from whole management to the dynamic of OHS are the most needed. Mostly of management are involve in daily safety activity. This involvement is not really help, fully commitment from all level of management is really needed. Participation in safety function, during safety inspection, conduct control in safety activity is the most important. Management participation is one biggest thing in safety changes behavior [1].

6) Legal Compliance

From the survey result related with legal compliance known that 25% from the total responder in management level has ”good” in term of compliance of OHS regulation, while 75% classified as very good in compliance of regulation.

Compliance of regulation is one important thing to reach a good safety and occupational health. It is related to compliance for government regulation, company regulation, OHS policy, division and compliance to all safety procedures applied. And etc. By seeing this result, this should be keep up and increase the compliance ti those regulation.

This graphic show legal compliance of management level related with safety behavior survey in GeoEngineering division.

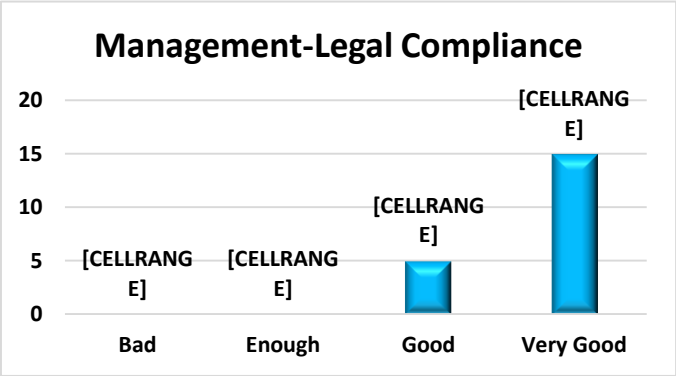


Fig 6: Graph of *Legal Compliance* for management level

4. CONCLUSION AND SUGGESTIONS

a. Conclusion

- From survey that had conducted, generally in GeoEngineering division has a good safety behavior.
- On Pratama level, in communication, awareness & attitude elements has good. While for knowledge & competence and responsibility also has good enough, however it is still need to improve especially in training and responsibility at field.
- On muda, madya level, known that awareness & attitude, responsibility has good and need to keep it up. While for knowledge & competence, communication and supervisory still need improvement, especially related eith training, communication improvement between supervisor-subordinate and vise versa. Also supervisory at field need to improved.

- On management level, communication, awareness & attitude, management commitment, responsibility and legal compliance has been good, its need to keep it up. While for knowledge & competence, still need to improve, especially in implementation of OHS in department and training of OHS, which still need to high to support the OHS performance in department.

b. Suggestions

- To increase knowledge & competence and responsibility on Pratama level, it is need to delivered training related with OHS also special training related with their job, in order their knowledge level, capability and responsibility to their job and safety hopefully increased. Training which important delivered to Pratama level such as role and responsibility to OHS, OHS communication, OHS behavior, OHS promotion at work and advantages of OHS implementation to employee, etc.
- Muda-Madya level need to improved their competence and knowledge in term of occupational health and safety. Muda-madya level are wished to have responsibility in doing a job also for their subordinate. Giving training about supervisory and leadership is one of mandatory material to muda madya level in order able to supervise and guide their subordinate correctly. The training module, which needed to delivered to muda madya level such as: safety leadership & supervisory, role and responsibility of supervisor to OHS, OHS behavior, OHS communication, OHS promotion at work, etc.
- For management level, it is also need to improve knowledge & competence because management level has a bigger responsibility to OHS, either subordinate and for job. Training which need to deliver to management level such as: safety leadership for management, role and responsibility of management to OHS, effective OHS communication, safety behavior changes, commitment to OHS, OHS promotion at work, safety reward and punishment, etc.

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The Study of Accident Investigation Activity In Indonesia Mining Sector

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Abstract

The accident that happened in an organization is an important learning tool to make an organization safer and healthier. When the accident or incident was not well investigates, the opportunity to learn will be wasted and a repetition of the accident might be occurred in the future. The occurrence of similar accident to several mining company in 2012, 2015 and 2017 has indicated that there is no lesson learned from accident.

In order to answer the cause of that problem, a descriptive study through literature and standard regulations review was establish to get an overview about learning process of accident and accident investigation activity. Based on this review, it showed that SCAT method is still use as a standard method. Using a particular kind of method is not a bad thing. But, by seeing the development of accident investigation model and method also the principle that there is no one model or method that can be used for all type of accident, so there must be an effort to learn another model and method to investigate an accident.

Keywords: Accident, Investigation Method, Accident Model

1. INTRODUCTION

The occurrence of similar accidents in some mining companies in Indonesia in 2012, 2015 and 2017 indicates that there is no process of learning by accident [1]. The learning process is not generated maximum lesson learn from the accident investigation activities can be attributed to many factors. A Shallow information

obtained during the accident investigation [2] can be one of the reason. The competence of an investigator also greatly determines the quality of the results of an accident investigation [3].

A repetition of the accident in an organization sometime it wasn't caused by unknown act to prevent it, but it was causing by unused the knowledge [2]. Organization has no learn from the accident in the past. Worker are often get those information and when they are resign, the information are also gone with them [2]. Other things also come from the problems caused by the structure and function within the company that hinders the learning process from the accident that happened [4].

Study of accident investigation activity in mining sector in Indonesia is still rarely done. This study was conducted to get an earlier overview of accident investigation activity in Indonesia mining sector in order to improve and develop exact method to maximize of learning process from experience.

2. METHODS

This study was using descriptive research method. To get an answer of this research question, the author made a literature study about the development of investigation model and method from articles in book, handbook and journals. Review of rules and standard in Indonesia was taken to get a description about accident investigation process both from the side of government and company.

3. Literature Review

3.1 Accident Investigation

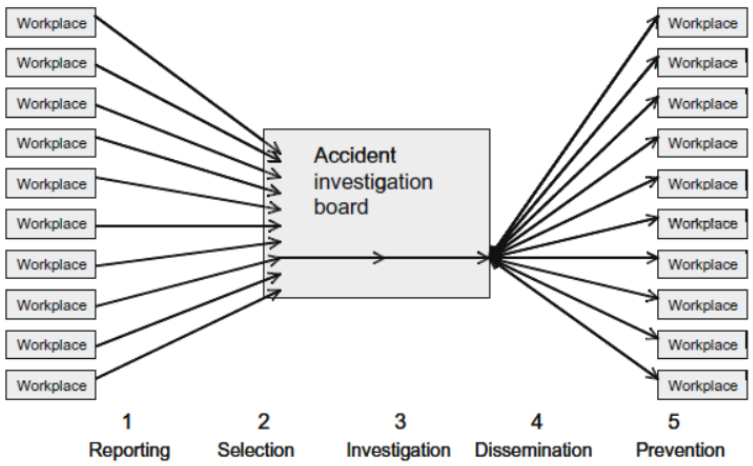
Generally, the concept of safety management and safety management system classified as a group of activities and document support to control safety [5]. Management safety system activities are safety policy, description of responsibility, safety training, audit, risk analysis, change management, safety standard, procedures, and experience feedback [6,7]. Accident investigation activity and accident report are activities as part of experience feedback which is safety management base.

Learning from previous accident is a main goal of accident investigation activities to prevent from similar accident in the future [8]. To perform accident investigation

depend on many reason and purpose also depend on the organization that organize it (company, government, or public institution) [9]. Accident investigation activities are conducted to determine the causes of accidents and to develop efforts to prevent similar events in order to create a safe workplace within a company.

In the context of government and public institutions, accident investigations are undertaken to derive full conclusions [8] for the prevention of similar accidents in the sectors they handle by widespread dissemination of investigative results. Model developed by Lindberg and Hanson 2006 [10], describing of the investigation which perform by government or public council to get a feedback of the accident that known as CHAIN Model (Figure 1). This model explains step by step in accident investigation in the context of industry and government or independent councils. The first step of this model is reporting accident from industry, second step is report selection to deeper analysis, third step is investigation which is primary step of the process, forth step is disseminating investigation result, and fifth step is preventive recommendation of dissemination result.

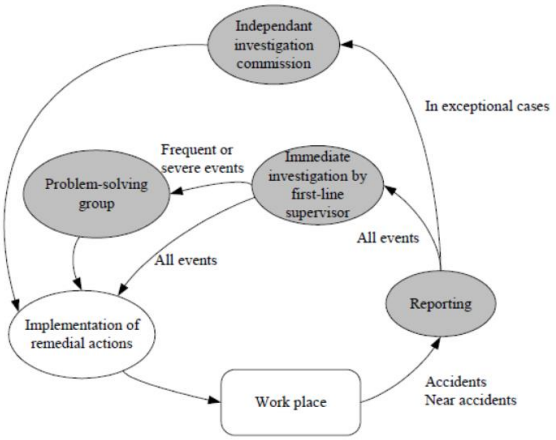
FIGURE 1. CHAIN Model (Lindberg, 2010)



In company/organizations context where the accident occur, the developed investigation by Kjellen 2000 [11], can be adopt to make investigation process easier (figure 2). Investigation has performed in 3 levels. Level 1 for all reported incident, made by supervisor and person in charge of safety. Level 2 for recorded accident,

repetition and near miss incident with moderate loss (for example can't back to work for couple day) made internally by team. Level 3 for rare incident, where potential loss are bigger, investigation has made by independent team. Accident are classified in to 3rd level is an organization accident as mentioned by James Reason [12]. Organization Accident is a product of innovation of technology, which radically change the relation between system and human element within it, Reason 1997 [13]. Whereas individual accident is an accident which certain people or group of people both of them often become an agent and or the victim of the accident [12].

FIGURE 2. Three Level Of Accident Investigation (Kjellen 2000)



When is the best time to stop the investigation? This is a basic question for every investigator who performed an analysis. So that, a performed of investigation task will be match with its designation. According to Reason [14] the stopping rule of an accident investigation depends on the purpose of each investigating agency. On company, accident investigation should be done to find out the failure of their management system and developing risk reduction that they can implemented under their authority. Government institution can be focus as far as investigation on the level of a weak regulatory system until it affects the occurrence of the accident in industry. The police are responsible for investigating in case of potential criminal come off.

3.2. Accident Model

Accident model is a stereotypes perspective about how an accident occur [15]. Accident model provide knowledge about basic mechanism that become a background

of the accident scenario, where the investigation method providing information that needed to analyze the accident in specific structure [16]. The model of accident occurrence is closely related to accident investigation activity. Kjellen [17] explained that accident occurrence model will support the investigator to :

- Making mental overview from accident structure.
- Asking the right question and define data that must be collected.
- Establishing stop rule (for example the rule of when to stop searching to new reason which have nothing to do with the accident occurrence).
- Checking that every relevant data has been collected.
- Evaluating, structuring and summarizing data become a meaningful info.
- Analyze the relationship between the pieces of information and notice the correlation of it.
- Communicating with others through the provision of term of reference that easy to understand.

Andersson 1995 [18] spell out the developing of the cause of accident model from the "primitive" one focused to one accident with one factor or one person involved, thus the newer model finding a complex abnormality, multifactor correlation, involving many people and environment as a whole. Some author tried to classified models that already create, start from Domino Heinrich model to functional resonance accident model.

Table 1. Classification of Accident Model

Classification	Description	Authors
Causal Sequence Model	present an accident as a chain of events that finally ends in some kind of loss.	Urban Kjellen & Eirik Albrechtsen 2017 [17]
Process Model	explain an accident as deterioration from a normal state to deviations that lead to loss of control and injuries	
Energy Models	explain accidents as transfers of energy and show how barriers can prevent or stop the energy flow and thus protect victims.	
Logic Tree Models	present causes of accidents in terms of logical relations among events and conditions in the affected system.	

Classification	Description	Authors
Systems Models	pay particular attention to human, technical, and organisational factors or to the interplay among them. These include management models and so-called systemic models that consider the dynamics and complexity of accidents.	
Cognitive Models	analyse human errors in terms of failures in cognitive function – how these are caused by contextual variables and how these variables lead to accidents (presented in Chapter 10).	
Chain of Event	Risk defined as weakest link in the chain	Sydney Dekker 2014 (19)
Barrier (Swiss Cheese)	Risk defined as accident trajectory not stopped	
System Theory	Risk defined as a control problem	
Drift	Risk defined as gradual acceptance of lower margins	
Linier	accident is the overall description of a series of events, decisions and situations culminating in injury or damage a chain of multiple events	BOK 2012 [20]
Complex Linier	focus on the view that accidents happen in a linear way where A leads to B which leads to C and examine the chain of events between multiple causal factors displayed in a sequence usually from left to right	
Complex Non Linier	tightly coupled systems had little tolerance for even the slightest disturbance which would result in unfavourable outcomes.	
Sequential Accident Models	the accident as a sequence of events in a specific order	Panagiota Katsakiori, George Sakellaropoulos, Emmanuel Manatakis, 2009 [16]
Human Information Processing Accident Models	the accident in terms of human behaviour and actions	
Systemic Accident Models	model which include organisational and management factors and describe the performance of the whole system	
Sequential Accident Models	Accidents as the result of sequence of events that occur in specific manner	Erik Hollnagel 2002 [31]
Epidemiological Accident Models	Accident is analogy with disease i.e., as the outcome of a combination of factors, some manifest and some latent, that happen to exist together in space and time	
Systemic Accident	these models endeavour to describe the characteristic performance on the level of the system as a whole,	

Classification	Description	Authors
Models	rather than on the level of specific cause-effect "mechanisms" or even epidemiological factors. Instead of using a structural decomposition of the system, the systemic view considers accidents as emergent phenomena, which therefore also are "normal" or "natural" in the sense of being something that must be expected.	

From table 1 it appears that, the classification of accident-causing models is divided into various classes according to the point of view of each of the founders. From some of the classification, author prefers to explore the classification from BOK 2012 [20] which more simple and easy to understand. Classification accident causing model can divide to linear, linear complex and systemic and non linear complex. In simple linear model accident is assumed as culmination of a series of related incident in sequences on one straight line so that to prevent accident by eliminating one of cause the linear component. Model which part of this category are Domino Heinrich model and Bird & Germain Loss Causation Model. Complex linear model based on presumption that accident is a result of the combination of unsafe action and latent condition in system that follow linear path. To prevent accident at this model is by strengthen barrier and obstruction. Model which part of this group are Energy Damage Model, Time Sequence Model, Epidemiological Model, Systemic Model (Swiss Cheese Model). Newer model of cause of the accident is a systemic model which assumed that the accident is no longer linear thing. Accident is assumed as the interaction result between environment variable and only to know and understand the combination and interaction of many factors accident can be identified and prevented. Model which part of this category are Systems Theoritic Accident Model and Process (STAMP) and Functional Resonance Accident Model (FRAM).

The model of the occurrence of accidents will greatly affect the views of an investigator in carrying out accident investigation activities. Model of accident occurrence will greatly affect to develop an investigation. ESREDA, 2009 [9] explain that accident occurrence model and system model are needed to connected accident occurrence to performance of organization system. Accident occurrence model is

needed to set the incident stage structure to reflect the character of sequences and accident time and to explain causative factor in incident chain. Models will show the cause of accidents related to the structure and clarity of the dynamism and complexity of the incident. It will also show the factors and actors on the sequence of events. Clarify relationships and interactions among factors, actions and decisions.

As is coming the new model, that's doesn't mean practically will better and easier to being used [20]. One of the problems with new model is the more complex of finding factor not connected to analysis system and data collection that already exists presently [21]. The research by underwood & Patterson, 2014 [22] whose doing accident analysis with complex linier base method and systemic model showed that SCM of complex linear generation is still usable to use in accident analysis.

3.3. Accident Investigation Method

Generally accident investigation will follow the method or certain procedure which is a regulation in a country, institution or organization. The method of investigation is the sequence of steps to obtain the results of the investigation [23]. The investigation method that is made will usually refer to one or more accident models tailored to the ultimate goal of the desired analysis. Methods of investigation will determine the direction of the findings to be obtained [24]. Process and result of investigation are very important to understand the vulnerability and the opportunity of working improvement that related to the accident [25]. When starting to an accident investigation activity, an investigator should have come with certain of think framework to make an investigation process easier. As same as principle of What You Look For Is What You Find (WYLFIWYF) (26). Assumption in implicit and explicit way as a basic of model improvement is also need to known by an investigator so that the investigation result is not bias [26].

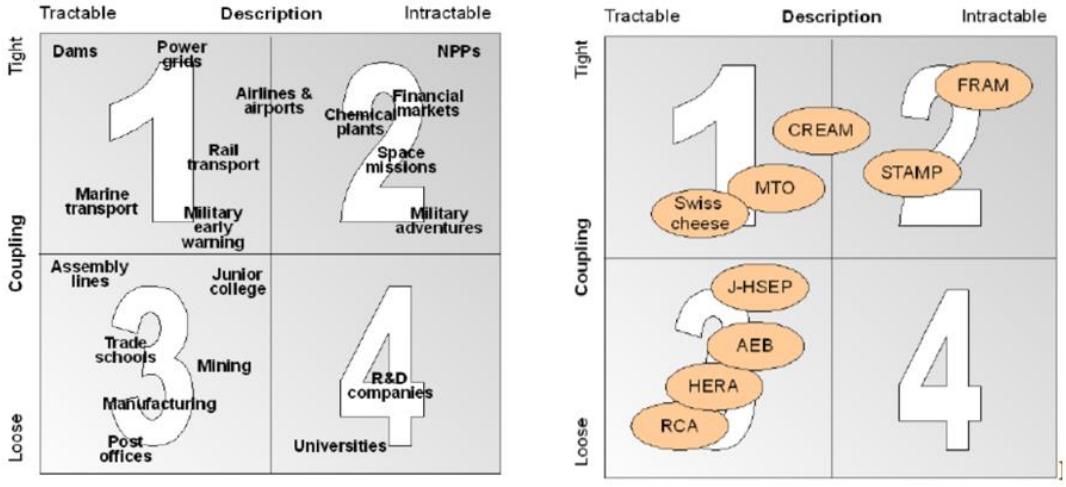
Methodology and procedure that developed to analyze the accident must be capable of providing information that can be used to preventive recommendation in the future [8]. There's a lot of investigation method that have been create on the whole world. Wienen et all, 2017 [23] summarizing 63 investigative method according

to paper analysis about those method in the internet which classified to sequential, epidemiology, systemic and others.

Selection of methods to be used is not a simple matter [22]. The relationship between the accident model and the method of accident investigation should be considered. Important principle of an accident investigation is to prevent the repetition of the same accident in the future [28]. Le Cose 2008, said that the different of investigation method should be used depend on the purpose of analysis and available resources. Investigation method effectively to explain an accident, but not effective yet to make an organization safe [27]. There is still a need for comprehensive action from the proactive side to create healthy and safe workplace conditions.

As a base to perform of selecting the right investigation method to be use to analyzing an accident is by considering the type of system that will analyzed [22]. Hollnagel, 2008 [26] have already create the category from many organization according to coupling and tractability principle that modify from Perrow diagram

Figure 3. The Relationship of System Characteristics and Investigative Method



Furthermore, Hollnagel [26] also explaining to perform method selection that suitable to investigation, some of the following question need to be considered. Because, basically certain of method is not superior from others, but more of the suitability with system characteristic. Below are the questions that need to be considered by an

investigator before determine the right method with the system characteristic that will be analyzed [26] :

- *"Was the accident similar to something that has happened before, or was it new and unknown? (The reference should be the history of the installation, as well as industry wide).*
- *Was the organization ready to respond to the accident, in the sense that there were established procedures or guidelines available?*
- *Was the situation quickly brought under control or was the development lengthy?*
- *Was the accident and the material consequences confined to a clearly delimited sub system (technological or organizational) or did it involve multiple subsystems, or the whole installation?*
- *Were the consequences on the whole expected / familiar or were they novel / unusual?*
- *Were the consequences in proportion to the initiating event, or were they unexpectedly large (or small)?*

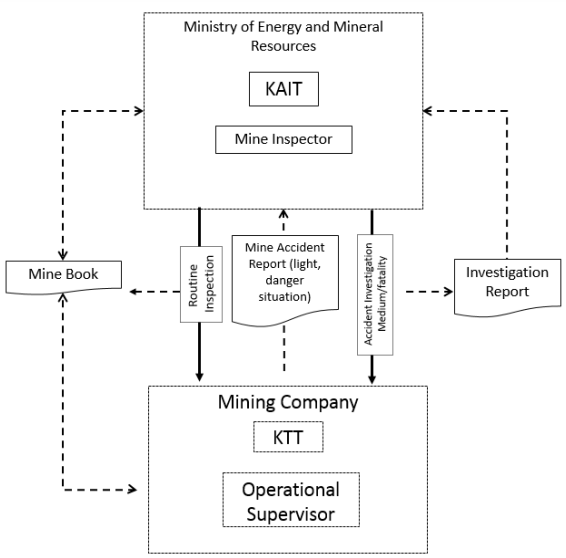
The first three questions illustrate issues that relate to the dimension of tractability. If the questions are answered positively, it indicates that the system was tractable, at least to some degree. The opposite is the case if the questions were answered negatively. Questions 4-6 illustrate issues that relate to the dimension of coupling. If the questions are answered positively, it indicates that the system was of the loosely coupled type. The opposite is the case if the questions were answered negatively."

In the end there's no one method that use for all the type of accident. Just like said by James Reason et all 2006 [29] *"accident will occur in many different size, shape and formation. That's why too naïve if we thought only one model or one type of explanation is enough to answer those problems. Some of the accident is very simple so that only need a simple explanation and model. Thus some of accident needed comparison of couple model and method to analyze and future improvement action.*

3.4. Accident Investigation Activity in Indonesia Mining Sector

To ensure the enforcement of legislation in mining industry, Republic of Indonesia government have instruments to simplify the coaching and monitoring on Occupational Safety and Health unit in mining industry (figure 4). This structure consist of officer from Directorate General of Mineral and Coal Ministry of Energy and Mineral Resources/MEMR that consist of (Chief Inspector of Mining/KAIT and Inspector of Mining/IT) and officer of the company that consist of (Mine Technical Manager/KTT and Operational Supervisor). To documenting monitoring result and other thing, Directorate General of Mineral and Coal and Mining company is listed in a book which called Mining Book.

FIGURE 4. Monitoring Occupational Safety and Health in Mining Sector



A KTT in company is responsible for the implementation and obedience of occupational safety and health legislation on a mining business activity in his responsibility area (clause 1 Ministerial Decree PE 555.K/26/M.PE/1995). In order to doing his job, KTT will be assisted by an Operational Supervisor whose duties are to carry out inspection, examination and testing, responsible for the safety, health and welfare of all persons under his responsibility.

In case an accident occur in the mining company causing severe injury or death, the company is required to report immediately to KAIT (clause 41 subsection 3 Ministerial

Decree PE 555.K/26/M.PE/1995). Accident with category exclude severe injury or death, KTT is required perform accident investigation not more than 2 x 24 hours maximum and write the report on special format. (Form III.I and Form X.i) which is then sent to KAIT (Clause 42 and 43 ministerial decree PE 555.K/26/M.PE/1995). Otherwise if the accident causing severe injury or death, the one who perform investigation is Mine Inspector/IT.

According to Decree of MEMR No 43 year 2016, which regulates the Standard of Special Competency in the Field of Mineral and Coal Mining, the Operational Supervisor is divided into three levels, they are First, Second and Third Operational Supervisor. To carry out the accident investigation competence in this regulation (code PMB.P002.0041.01) is a unit of competency required for the first operational supervisor. So it can be concluded that the obligation to carry out an accident investigation in the company is all levels of operational supervisors first, young or middle. In mining company generally first operational supervisor is on the same level with OSH Staff/Supervisor, Second Operational Supervisor is on same level with Supervisor/Superintendent and Third Operational Supervisor as same level with OSH Manager.

To perform accident investigation in mining sector in Indonesia, refer to Technical Guidelines of Accident Investigation Format Report on Mineral and Coal Mining. In this guideline, accident investigation method is refers to ILCI Loss Causation Model as known as Systematic Causal Analytical Technique/SCAT [12]. The reporting format and the investigation steps to be performed should follow this technique. Another guideline that can be followed to perform accident investigation is SNI 7081-2016 about mining accident investigation and environment hazardous incident. In this standard accident investigation method not focused on only using SCAT method. Accident investigation can be performed by using another method that suitable with investigator decision. In this standard, the direction of analysis result not intended just to see the surrounding factors that causing incident only, it is also open if the result of investigation was found another factor such as latent condition that underlying cause of the accident.

5. DISCUSSIONS

Mining Industry in Indonesia has its own institution that created by government to carry out accident investigation activity. This institution called Sub Directorate of Health and Safety of Mineral and Coal Mining at Directorate Technical Environment Mineral and Coal Ministry Energy and Mineral Resources. When accident occur in Mining industry that cause severe injury or death, and hazardous incident occur which classification has determine or the occurrence of environment pollution cases, the functional officer of mine inspector will be assigned as independent team to investigate the incident.

In performing its duties the mine inspector has guidelines for the execution of duties in the form of technical guidance to conduct accident investigation activities. This guideline becomes important to review, because it leads him just to see the accident only from incident and cause side around the place of accident. It causing by investigation frame are made based on Domino Theory which focus on incident around accident (direct cause: unsafe act & unsafe condition, basic cause: job factor and personal factor and the lack of management control: lack of program, lack of standard program, lack of obey the standard). By doing this analysis technique, the finding direction is tends to not developing. The development of accident model that has entering organization factor since the 90s which known as latent condition [20] it can't be shown because of the method used has limitation which perform by checklist frame. Limitation checklist causing digging the information will only make based on what is on the list.

SNI 7081-2016 opening the opportunity for a mine inspector/operational supervisor to use another investigation method when perform accident investigation activity. In implementation in the field, a mining inspector/operational supervisor should be seeing another factors especially for certain cases for example the accident with great number of victim or repetition accident as a concept that develop by Kjellen 2000. Beside of determine the method that will use in the beginning, the understanding of accident model also simplify collecting data and making conclusion. Principle of What You Look For Is What You Find (WYLFIWYF) by Hollnagel 2008 [26] in

the end, it is an absolute thing to understand by institution or individual who perform accident investigation to get the best investigation result.

In the early stages, to improve the capability of suitable investigative methods used in accident investigation activities in the mining sector, investigation methods in the 3rd quadrant of figure 3 can serve as a reference for increasing knowledge of investigative methods. Another method that can also be considered, to be a reference is the methods developed based on latent condition theory, because sometimes accidents are not caused by unsafe actions but more due to failure to make decisions at the level of the organization such as events related to slope mine slope suddenly.

6. SUMMARY

Accident model is a guide for an investigator to determine the direction of the investigation activities to be performed. By understanding the accident models, an investigator will easily be able to determine the appropriate investigative methods applied in conducting accident investigations in line with WYLFIWY Hollnagel principles. The application of different investigation methods may be performed by investigators (either mining inspectors or operational supervisors) on certain types of accidents such as accidents that cause major losses or recurrent accidents

It is interesting to conduct further research on accident investigation models in mining companies to find out the characteristics of the investigative methodology developed in the Indonesian mining sector. A review of the investigation methods that can be a reference, with the increasing complexity of technology and systems within mining companies such as the number of subsystems in operation associated with contractors, the existence of metal mineral purification activities, Indonesian geographical factors in the tropics with high rainfall, also need to be understood for see the overall crash-related issues.

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Medical Facilities Assessment In Keningau, Sabah For X Project on 2015

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Abstract

A hospital plays an important role in healthcare. A good hospital should be capable to operate on a daily basic activity, able to do a surgery, able to pick up and transport patient, and able to operate during a disaster or on disease outbreak. The objectives of the assessment are; to understand the common communicable diseases in Pinangah and recommend prevention measures and assess the existing medical facilities and recommend scope of utilization of medical facilities for medical and emergency management. The method used in this assessment is collect data from the hospital with interview, observation and records from hospital. Result; This hospital can Stabilize Emergency Case, capable for most of Surgical case, can treat most of medical care, can do most of laboratory check. Have a 24 hours standby ambulance, and have a helipad for pick up or transport a patient. Have an emergency team can be iniatiated when emergency or disaster occurs – Headed by Hospital director. Based on the information from Pejabat Kesihatan Kawasan (PKK) Pinangah on endemic communicable diseases in Pinangah are malaria, leptospirosis, and cholera. Conclusion; This is a good hospital that can treat minor cases, almost all major cases, have a good transportation unit, and have an emergency team that can be initiated during emergency or disaster, but this hospital can't treat a major burn cases. This hospital can build a room and team to treat major burn cases, and we need to conduct similar assessment in Indonesia for mapping all hospital ability to operate during disaster or disease outbreak.

Keywords: Hospital, Hospital Assessment.

1. INTRODUCTION

Keningau District population density is about 184.000 people (Health Facts Sabah 2007). Natives that lived in this area are the Kadazan / Dusun, Murut, Chinese and others. The primary occupation in the area are agriculture and plant oil palm industry. In the past Keningau District is one of the logging area [1].

Keningau Hospital has been operational since May 13, 1957, as a "Cottage Hospital" built on a hill with an area of 9.2 Hectare. Distance away from Keningau town center about 1 KM. By 2003, HKGU has grown and able to accommodate 150 beds [1].

Construction of new hospital with an area of 11.15 hectares, is located at KM 5, Jln Apin-Apin/Keningau started operations on 08 February, 2004, the number of 212 beds under the Ninth Malaysia Plan projects-8. Keningau Hospital has been equipped with modern equipment IHIS Information Systems 'Information System Intermediate Hospital' which is a computerized management system for patients and staff [1,2,3].

A hospital plays an important role in healthcare. A good hospital should be capable to operate on a daily basic activity, able to do a surgery, able to pick up and transport patient, and able to operate during a disaster or on disease outbreak.

The objectives of the assessment are as the following:

- Understand the common communicable diseases in Pinangah and recommend prevention measures
- Assess the existing medical facilities and recommend scope of utilization of medical facilities for medical and emergency management.

2. METHODS

This assessment was made using a qualitative description method, where the sample is one hospital. Data were collected from deep interview with the hospital management and medical staff (doctors and paramedic), observed the condition of equipment, unit, room and building, and hospital records from previous year, and also a collected data from Pejabat Kesihatan Kawasan (PKK) Pinangah. We used a checklist provided by the company to assess the hospital.

3. RESULTS

For communicable endemic diseases they collected data from Pejabat Kesihatan Kawasan (PKK) Pinangah. Based on the information from Pejabat Kesihatan Kawasan (PKK) Pinangah on endemic communicable diseases in Pinangah are:

- Malaria (predominantly due to Plasmodium knowlesi) with mosquitoes as a vector.
- Leptospirosis – consumption of contaminated food / drinking water by rodent urine.
- Cholera – consumption of contaminated food/drinking water due to poor sanitation.

There are total of 57 medical doctors (including hospital director) and 12 Specialist; Pediatric, Obstetric and Ginecologist, Surgeon, Internal Medicine Specialist, Nephrologist, Cardiologist, Resporatory Specialist, Emergency Specialist, Ophthalmologist, Anasthetist, and including 1 on call (ENT Specialist). This hospital also has 400 registered nurse/paramedics in this hospital. Outpatient department is over-crowded. Around 100 patients seen by medical officer per day, and aroud 8-10 patients admitted per day.

For emergency and trauma, this hospital have 24 hours emergency departement with 24 hours admission, 24 hours qualified standby doctor, 3 defibrillator, 8 patient monitor, 3 Resucitation trolley that checked every shift, and this hospital has a mass casualty emergency preparedness, and response plan, especially for disaster management plan, external and internal. Emergency team can be iniatiated when emergency or disaster occurs – Headed by Hospital director. The hospital has 6 ICU beds, 2 beds just for cardiac cases, 6 ventilator, 6 patients monitors and 1 anaesthetist specialist responsible for ICU; 4 Operation room, 1 for obstetric and gynecologic, with 2 general surgeon; 3 X-ray machine with 1 CT Scan Machine. Burn management room is available, but can't treat severe burn injury. For severe burn injury they have to send the patient/ IP to Queen Elizabeth Hospital, Kota Kinabalu.

For medicine and drug; this hospital have a qualified pharmacist to run a pharmacy for all patients. Medicine and drug are complete in this hospital, including an Anti-venom is available in the hospital for snake bites cases (anti-venom for Cobra).

This hospital have a laboratory that manage by qualified personnel and can do almost all laboratory check including bacteriology, microbiology, haematology, serology, biochemistry, urine drug screening, blood bank transfussion check rapid as well as confirmation test

For referral case, this hospital has ambulance vehicles available in the hospital and can be use 24/7, helipad is available in hospital area and can be used for chopper landing, but not suitable for night landing. For serious cases that cannot be treated in here, they will transferred the patient to Queen Elisabeth hospital which is 122 kilometres from this hospital.

Mortuary is available in Hospital Keningau. There are 2 rooms for Muslim and non-Muslim but no Forensic Specialist.

4. DISCUSSION

The incidence of malaria is high on jungle areas in Keningau district but not in town. Mechanical forms of protection are still the most effective means of preventing the spread of malaria, for example by using window and door screens, and mosquito bed net. There are 4 steps to mosquito prevention;

1) Protective clothing by wearing a long sleeved shirts and long pants in light colors such as beige or yellow. Dark clothing attracts mosquitoes, as does the scent of perfume or after shave-lotion.
2) Apply mosquitoes repellent – available in sprays, lotions – to all exposed areas of skin, as well as clothes, avoiding eyes and mouth.
3) Pyrethrin insecticides (active ingredient pyrethrin, extracted from pyrethrum flower. It kills mosquitoes instantly by acting on the central nervous system.
4) Preparing bed for the night and using a mosquito bed net.

For the leptospirosis, Malaysia government have released Guidelines for The Diagnosis, Management, Prevention and Control of Leptospirosis in Malaysia. The prevention and control should be targeted at the infection source, route of transmission between the infection source and the human host, and prompt and proper treatment of infection.

Cholera prevention can be done by avoiding contaminated food and maintain personal and environmental hygiene and sanitation.

5. CONCLUSION AND SUGGESTION

This is a good hospital that can treat minor cases, almost all major cases, have a good transportation unit, and have an emergency team that can be initiated during emergency or disaster, but this hospital can't treat a major burn cases. This hospital can build a room and team to treat major burn cases, and we need to conduct similar assessment in Indonesia for mapping all hospital ability to operate during disaster or disease outbreak.

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Competing interst

On this occasion, I would like to declare that I have no interest in any kind of competing interest from making this paper.

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Occupational Health and Safety in Warehouse Area

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Abstract

The warehouse was the place which is occurring process of lifting and delivering goods or materials. The activity in warehouse area could cause hazards. The fatal injury rate for the warehousing industry is higher than the national average for all industries. It's due to the activity in the warehouse using lifting equipment such as a crane, forklift and truckloads which is that equipment is widely used not only in warehouse industry but also used in various public infrastructure. Therefore, warehouse safety has evolved into public safety. So, it needed a risk assessment. Risk assessment was the most important stage in the field of occupational health and safety. A good risk assessment can improve the competitiveness of enterprises and the proper handling of risks for achieving company goals. To minimize that risk, then in this study did determinant the hazards and assess with Fine Kinney risk assessment method. This study was the descriptive study with a systematic review. Literature related to identifying hazards and risk assessment acquired from the research report, thesis, journal and also supporting books. Data took from 2003-2017. Data that has been collected then make it classified to determine the main criteria, sub-criteria and alternatives of hazards. Then, the risk score is obtained by formula W.T Fine. The result showed in the 1st hazard group level, the most important hazard was a physical hazard. The high risks in the 2nd hazard group level were the operation of a powered vehicle, crashing, manual handling, dust exposure and workload. Hit by forklift and handling heavy objects classified to the very high risks in the 3rd hazard group level. Therefore, it needed Forklift Management System or Risk Management for Forklift Operation.

Keywords: risk assessment, potential hazards, warehouse safety, Fine Kinney method, systematic review, occupational health and safety

1. INTRODUCTION

The ability of a production system would be determined by its supporting system. The warehouse was one of supporting and an important part of a supporting system. Good conditions and arrangements in the warehouse are expected to avoid corporate losses and minimize the cost incurred and increase operations and services at the warehouse [1].

The core of this industry was delivering materials. Materials which have gotten from production take to the warehouse before it distributed to the customer. This case was becoming warehouse one of the vital element in an organization. It needed exactly coordination between the availability, the distribution, and materials delivery to avoid overcrowded in the warehouse. Because of it can generate potency of the unsafe condition and warehouse inefficiency.

Since a large proportion of the cargo is completely or partially loaded through different warehouses, these logistics facilities become a critical link in supply chains [2]. Warehouse operations can present a wide variety of potential hazards for the worker. More than 145.000 people work in over 7000 warehouses. The fatal injury rate for the warehousing industry is higher than the national average for all industries. There were several potential hazards such as the unsafe use of forklifts, improper stacking of products, failure to use proper personal protective equipment, failure to follow proper lockout/tagout procedures, inadequate fire safety provisions and repetitive motion injuries [3]. Besides that, the most common causes of the accident in warehousing and storage industry were trips, fall and manual handling [4].

Risk management in warehouses is a key issue to guarantee security all along the global supply chains [2]. Besides that, warehouse safety has evolved to become public safety due to the use of much kind internal transportations. To minimize the hazards then required risk assessment as the most important stage in occupational health and safety field. A good risk assessment could improve the company competitiveness and the accuracy of risk control to achieve the company goal. Risk assessments are mostly conducted at the international or national level [5]. Therefore be required risk assessment in warehouse area to identify the potential hazards, the mitigation, increase of occupational safety and productivity of worker and company itself.

The main objectives of the literature review are to present an overview the most important hazards in the warehouse area, to present a hierarchy of hazards, to present a classify the level of hazards, and to present a risk assessment using the Fine Kinney method.

2. METHODS

This research used descriptive research design as a literature review. As data sources, we used reviewed article, publication, and informally published. Data took from 2003 until 2017. The commonly databased literature used was Google Scholar and Science Direct that have searched 4756 results. The search for a specific term like warehouse safety found 72 results. The final found 15 results which appropriate with researcher's objective.

From that results, we determined the most important hazards in the warehouse area. Then, we classified into 3 levels. At the 1st level, the hazards classify with their general names such as physical, ergonomics etc. More detailed hazard formed in the 2nd hazard group level. In the 3rd hazard group level expressing what type of accidents it could cause have been formed [6].

The method used in risk assessment was a semi-quantitative method to the definite level of risk in each hazard. Risk assessment using three parameters by Fine i.e consequences, probability, and exposure. Then, the risk score is obtained by multiplying these parameters [6]. The risk score classifications by Kinney [7].

The risk is evaluated by considering the potential consequences of an accident, the exposure or frequency of occurrence of the hazard-event that could lead to the accident, and the probability that the hazard-event will result in the accident and consequences. The formula is as follows risk score = consequences x exposure x probability. The abbreviated: R = C x E x P [8]. Definitions of the elements of the formula and numerical ratings are given below (Table 1-4).

Table 1. Consequences

Descriprions	Rating
Catastrophs. Numerous fatalities, extensive damage (over $1,000,000) major disruption of activities of national significance	100

Descriprions	Rating
Multiple fatalities. Damage $500,000 to $1,000,000	50
Fatality. Damage $100,000 to $500,000	25
Extremely serious injury. Amputation, permanent disability, damage $1,000 to $100,000	15
Disabling injuries. Damage up to $1,000	5
Minor cuts. Bruises, bumps, minor damage	1

Table 2. Exposure

Description	Rating
Continously. Many time daily	10
Frequently. Approximately once daily	6
Occasionally. From once per week to once per month	3
Unusually. From once per month to once per year	2
Rarely. It has been known to occur	1
Very rarely. Not known to have occured but considered remotely possible	0.5

Table 3. Probability

Description	Rating
Most likely. Expected result if the hazard-event takes place	10
Quite possible. Would not be unusual, has an even 50/50 chance	6
Unusual. Coincidence	3
Remotely possible. It has happened	1
Extremely remote. Has never happened after many years of exposure	0.5
Practically impossible. Has never happened in spice of exposure over many years	0.1

Table 4. Risk score

Risk score	Risk situation
> 400	Very high risk. Consider discontinuing operation

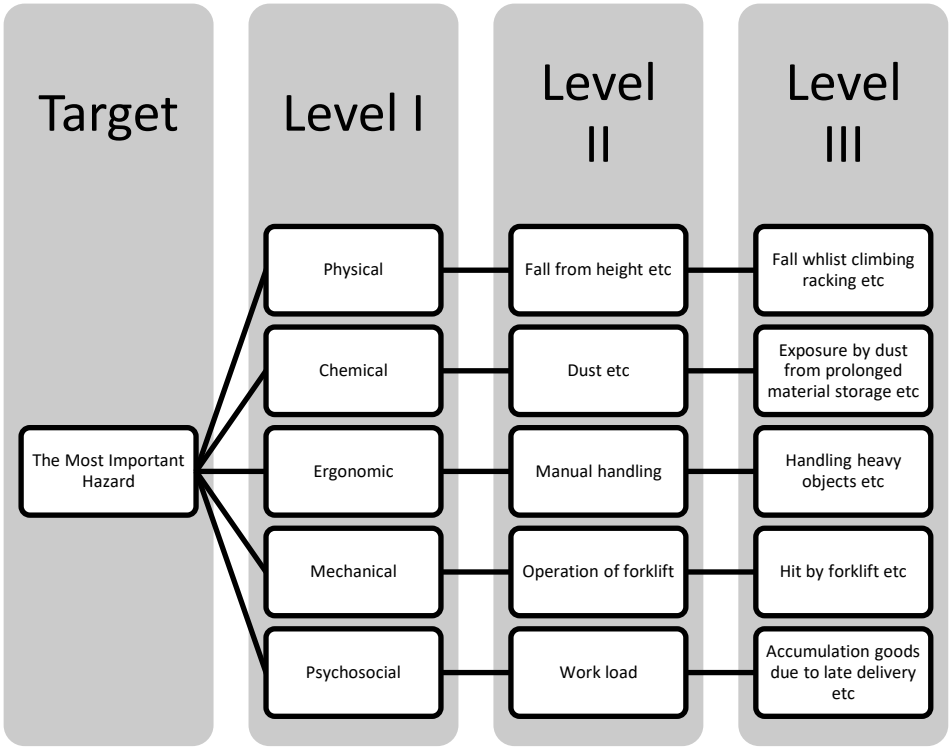
Risk score	Risk situation
200 to 400	High risk. Immediate correction required
70 to 200	Substantial risk. Correction needed
20 to 70	Possible risk. Attention indicated
< 20	Risk. Perhaps acceptable

3. RESULTS

The tasks in warehouse area were loading and unloading. The warehouse is divided into two, storage and coldstorage The difference in both was thermal exposure in the warehouse. However the activities overall equal. The main activities in warehouse area were receiving, storing and issuing. Wherein all activities consist of loading, unloading and transport materials [9]. All three activities involve lifting equipment and workers. Lifting equipment that is widely used in the warehouse area forklift, lift truck, and conveyor. Although the use of lifting equipment has been maximum to assist activities in the warehouse, however lifting objects manually still frequently used.

The potential hazards in warehouse area based on literature review among others fall from height, lighting, thermal stress, noise, crashing, fire and explosion, falling objects, electrical shock, radiation, trips, slips, bind, dust exposure, fumes exposure, manual handling, operation of powered vehicle, and workload (3,4,10–17). Afterwards, that hazards will classify to three level. The result of classifying hazards will be described in an example of hierarchy hazards (Figure 1). The details would be appeared with risk assessment by 1st hazard group level.

Figure 1. The example of hierarchy hazards



The 1st hazard group level was the category of basic hazard such as biological, ergonomic, psychosocial, chemical and physical [18]. The literature review result showed classification hazards in level 1 be physical, ergonomic, chemical, mechanical and psychosocial. The most common hazard and having the very high-risk was a physical hazard. Hazards identified in level 2 are fall from a height, lighting, thermal stress, noise, crashing, fire and explosion, falling objects, electrical shock, radiation, trips, slips, bind, dust exposure, fumes exposure, manual handling, the operation of a powered vehicle, and workload. The high risks in the 2nd hazard group level were the operation of a powered vehicle, crashing, manual handling, dust exposure and workload. In the 3rd hazard group level more specific to the causes of an unwanted event such as working in temperature up to 30 C etc (Table 5).

Table 5. Classification of hazard group level

1st hazard group level	2nd hazard group level	3rd hazard group level
• Physical	• Fall from height	• Working in temperature up

1st hazard group level	2nd hazard group level	3rd hazard group level
• Chemical • Ergonomic • Mechanical • Psychosocial	• Lighting • Thermal stress • Noise • Crashing • Fire and explosion • Falling objects • Electrical shock • Radiation • Trips • Slips • Bind • Vibration • Dust exposure • Fumes exposure • Manual handling • Operation of powered vehicle • Work load	to 30 C • Working in temperature below to 10 C • Working under the hot sun • Poor ventilation • Locked in the cold store • Poor lighting • Moving empty drums in the drumming line • Driving froklift with a noisy engine • Working near noisy source • Swaying metal pallets • Handling heavy objects • Prolonged repetitive movement • Untrained or improper manual lifting • Bending or twisting during lifting • Working with the arms above shoulder height to retrieve objects • Crashed by loading or unloading with forklift • Crashed into goods or pallets

1st hazard group level	2nd hazard group level	3rd hazard group level
		• Hit by forklift • Crashed while lifting goods • Hit by freight • Lift truck crashing other vehicle or other objects • Hit by vehicle • Hit by lift truck • Forklift run off docks • Powered equipment collision • Hit by falling products • Forklift electrical system • Over use electric equipment • Ignited through electrical fault • Smoke inhalation • Fierce due to stringed drums and floor • Improper use of lockout procedure • Recharging powered vehicles • Faulty electrical equipment or installation • Portable electrical equipment

1st hazard group level	2nd hazard group level	3rd hazard group level
		• Dust from chemical material • Dust from prolonged material storage • Dust due to poor housekeeping • Muffler emision (exposure of CO) • Falling objects from material storage • Product fall strikes worker or visitor • Falling objects during movement • Struck by a falling objects • Falling pallets or objects from racking • Falling pallets improper layout • Falling objects from vehicle • Falling improperly stored material • Operate forklifts • Operate other powered vehicles • Loading/unloading goods while machine truck on

1st hazard group level	2nd hazard group level	3rd hazard group level
		• Fall whlist climbing racking • Fall while changing light bulbs • Through fragile roof when looking for repairing leaks • UV exposure • Accumulation goods due to late delivery • Inadequate human resources • Slip on spillages • Slip on water or oil • Slip by poor housekeeping • Trip over objects • Trip over debris • Trip due to hole on the floor • Bind by pallets while racking • Bind pallet load • Bind machine • Bind in pinch points

Afterwards, all hazards in the 3rd hazard group level as the assessment were performed with Fine Kinney risk assessment method (Table 6-10). The result showed that hit by a forklift and handling heavy objects classified to the very high risks. The high-risk hazards were hit by

vehicle, hit by lift truck, over use electric equipment, ignited through electrical fault, slip by poor housekeeping, falling objects during movement, falling pallets or objects from racking, prolonged repetitive movement, bending or twisting during lifting and loading or unloading with forklift.

Table 6. Risk assessment physical hazards by Fine Kinney method

Hazards	P	E	C	Risk Score
Fall from height				
• Fall whlist climbing racking	6	2	15	180
• Fall while changing light bulbs	6	1	15	90
• Through fragile roof when looking for repairing leaks	3	1	15	45
Lighting				
• Poor lighting	6	6	5	180
Thermal stress				
• Working in temperature up to 30 C	3	2	15	90
• Working in temperature below to 10 C	3	2	15	90
• Working under the hot sun	6	3	5	90
• Poor ventilation	6	3	5	90
• Locked in the cold store	1	0.5	25	12.5
Noise				
• Moving empty drums in the drumming line	6	3	5	90
• Driving froklift with a noisy engine	3	2	5	30
• Working near noisy source	3	3	5	45
• Swaying metal pallets	6	6	5	180
Crashing				
• Crashed into goods or pallets	6	3	5	90
• Hit by forklift	6	3	25	450
• Crashed while lifting goods	6	6	5	180
	3	1	25	75

Hazards	P	E	C	Risk Score
• Hit by freight	6	2	25	300
• Hit by vehicle	6	2	25	300
• Hit by lift truck	6	6	5	180
• Hit by falling products				
Fire and explosion				
• Forklift electrical system	3	1	25	75
• Over use electric equipment	6	1	50	300
• Ignited through electrical fault	6	1	50	300
• Smoke inhalation	3	1	50	150
• Fierce due to stringed drums and floor	1	1	50	50
• Improper use of lockout procedure	3	1	50	150
• Recharging powered vehicles	3	1	50	150
Radiation				
• UV exposure	3	3	5	45
Slips				
• Slip on spillages	6	3	5	90
• Slip on water or oil	6	3	5	90
• Slip by poor housekeeping	10	6	5	300
Trips				
• Trip over objects	6	6	5	180
• Trip over debris	3	2	5	30
• Trip due to hole on the floor	6	2	15	180
Bind				
• Bind by pallets while racking	6	3	5	90
• Bind pallet load	3	2	15	90
• Bind machine	3	2	5	30
• Bind in pinch points	6	3	5	90

Hazards	P	E	C	Risk Score
Falling objects				
• Falling objects from material storage	10	3	5	150
• Produst fall strikes worker or visitor	6	2	5	60
• Falling objects during movement	10	6	5	300
• Struck by a falling objects	6	2	5	60
• Falling pallets or objects from racking	6	3	15	270
• Falling pallets improper layout	6	3	5	90
• Falling objects from vehicle	3	2	15	90
• Falling improperly stored material	3	2	5	30
Electrical shock				
• Faulty electrical equipment or installation	3	1	25	75
• Portable electrical equipment	3	1	15	45
Vibration				
• Operate forklifts	3	10	5	150
• Operate other powered vehicles	3	6	5	90
• Loading/unloading goods while machine truck on	3	3	5	45

Table 7. Risk assessment chemical hazards by Fine Kinney method

Hazards	P	E	C	Risk Score
Dust exposure				
• Dust from chemical material	3	3	15	135
• Dust from prolonged material storage	6	6	5	180
• Dust due to poor housekeeping	6	6	5	180
Fumes exposure				
• Muffler emision (exposure of CO)	6	6	5	180

Table 8. Risk assessment ergonomic hazards by Fine Kinney method

Hazards	P	E	C	Risk Score
Manual handling				
• Handling heavy objects	6	6	15	540
• Prolonged repetitive movement	6	10	5	300
• Untrained or improper manual lifting	3	3	5	45
• Bending or twisting during lifting	6	10	5	300
• Working with the arms above shoulder height to retrieve objects	6	6	5	180

Table 9. Risk assessment psychosocial hazards by Fine Kinney method

Hazards	P	E	C	Risk Score
Work load				
• Accumulation goods due to late delivery	6	6	5	180
• Inadequate human resources	3	3	5	45

Table 10. Risk assessment mechanical hazards by Fine Kinney method

Hazards	P	E	C	Risk Score
Operation of powered vehicle				
• Loading or unloading with forklift	6	3	15	270
• Forklift run off docks	3	2	15	90
• Powered equipment collision	3	1	50	150
• Lift truck crashing other vehicle or other objects	3	2	25	150

4. DISCUSSION

Potential hazards which include in very high-risk categories need control before continued the operation. Based on risk assessment of potential hazards showed that hit by forklift was the very high risk in the warehouse area. About 100 employees are killed and 95,000 injured every

year while operating forklifts in all industries. Forklift turnovers account for a significant percentage of these fatalities [3]. The frequency of accident by forklift included occasionally whereas it could happen from once per week to once per month. A case study in one of milk factory in Jakarta stated that in 2016 recorded 12 incidents occupational accident related to the operation of forklift [19]. The probability hazard-event occur included expected if the hazard-event takes place. The losses that appeared from the hazard-event were higher. It caused fatality and property damage $100,00 to $500,000. In case study above, from 12 accidents by operation of forklift be obtained 3 accidents with medical treatment injury classification, 4 accidents with first aid injury classification and 5 properties damage [19]. This risk assessment can be guidance for each company to give more supervision related to using forklifts. For example, an organization can apply Forklift Management System or Risk Management for Forklift Operation. Recently in almost shopping center are using forklift freely because of forklifts has been internal transportation for all industry. This requires more attention to the risks that will arise wherein the shopping center is not only workers who involved activities, but also visitors who need to get information related to safety forklift operation.

The other very high risk in warehouse area was handling heavy object. Lifting manually has become commonplace for many people. Occasionally, a man would admit he was strong if he could lift a heavy object alone. Actually, the maximum load that may be lifted by someone based on NIOSH is 23-25 kilogram [4]. In other words, the load raised does not exceed 50% personal strength limit. This forgets the effect that the person will experience for the long term. Working with the handling of heavy objects is more often done by workers with low socioeconomic levels [20]. This sometimes caused a lack of long-term health awareness for workers. Health effects from handling heavy objects were low back pain and musculoskeletal disorders [4] which is a serious problem in both developed and developing countries. In Europe, 30% of workers experience low back pain. Injury from handling heavy objects contributes about 40% and spends about $ 28.5 million annually on South Australian society [21]. With the development of technology in the workplace make resources, especially manual handling work is reduced. Usually diligent and young workers who will remain employed so that the exposure received by workers more. Statistics show low back pain can occur in men with age range 20 -

24 years. Other factors that can support the risks include smoking and work done by workers outside of work [19]. In this case, all warehouse industries have implemented the use of personal protective equipment, one of which is back support. Potential danger can also be reduced by the risk of procurement training manual handling, stretching while working and procurement of sports together in the work environment.

The others include high-risk category such as hit by vehicle, hit by lift truck, over use electric equipment, ignited through electrical fault, slip by poor housekeeping, falling objects during movement, falling pallets or objects from racking, prolonged repetitive movement, bending or twisting during lifting and loading or unloading with forklift. These high-risk hazards need correction immediately. Commitment, training and various safety programs conducted by the company to reduce the risks arising. Safety programs that can be done include increased LOTO program, training lifting manually and improve safety culture in the warehouse area.

Many corporates are aware of the warehouse safety. one of them is PT Trakindo who always performs periodic inspections in the warehouse area [11]. Therefore, it critically to have good risk management in warehouse area to business survival. Besides that, creating a safety culture within a warehouse is important. Warehousing risk management involve fire safety, hot work fire safety, flooding, security, worker safety, material storage, battery safety, electrical safety, storage and handling of environmentally hazardous substances [22].

5. CONCLUSIONS

The literature review has been conducted potential hazards in the warehouse. In the 1st hazard group level, the most important hazard was a physical hazard. The high risks in the 2nd hazard group level were the operation of a powered vehicle, crashing, manual handling, dust exposure and workload. In 3rd hazard group level showed that hit by a forklift and handling heavy objects classified to the very high risks. The high-risk hazards were hit by vehicle, hit by lift truck, over use electric equipment, ignited through electrical fault, slip by poor housekeeping, falling objects during movement, falling pallets or objects from racking, prolonged repetitive movement, bending or twisting during lifting and loading or unloading with forklift. Therefore, it needed Forklift Management System or Risk Management for

Forklift Operation and clearly regulation about standarize load of lifting manually. The next is monitoring and evaluating that control.

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The Association between Work Shift and Fatigue

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Abstract

Currently, shift work is common in the working population in various industries. Work shifts are known to have several health effects, (eg fatigue, anxiety, cardiovascular problems, and gastrointestinal problems) as well as increased accident rates. However, there are not many studies that specifically investigate the difference between day shifts and night shifts, and long shifts in reported fatigue. Relevant studies of shift and fatigue work between 2010 and 2016 were obtained through electronic databases. 11 The journal meets the inclusion criteria. The journal used in this literature study uses a cross sectional research design with data collection through questionnaire, measurement of fatigue level with reaction time and speed and accuracy test of Wiersma boundor. This literature study concludes that the night shift has the greatest fatigue rate followed by the afternoon shift and morning shift. Hence, this study suggests to reduce the prevalence of fatigue that can cause accidents for night shift.

Keywords: Work Shift, Fatique Level

1. INTRODUCTION

As the population growth is high enough, the population's needs in terms of material, health, or others, increase. These needs encourage companies to provide the population the materials, health, or others, they need by producing them in large quantities in a short time. This large amount production done in a short time brings domino effect to encourage the companies to produce them continuously and ultimately force the employees to work in work shifting system in order to meet the demand needs of the customers, although there is no definitive statistical

data on the number of shift laborers working in Indonesia or other countries, it is certain that more than half of the workers are involved in the shift system.

The number of accidents happened to the industry (in 2015, the number of accidents happened according to the claims of the Workers Social Security Agency (BPJS) was as much as 110,285 cases) one of the causes of the accident was the unsafe act did by fatigue workers. The fatigue was caused by many things and one of them is the work shift system. This literature study was conducted to find out the comparison of workers' fatigue levels in the morning, afternoon, and evening shifts so that the shift with the highest fatigue level and improvement actions can be decided to minimize potential accidents caused by fatigue.

Based on the above description, the authors are interested to write a literature study entitled The Association between Work Shift and Fatigue in order to be a Reference to Determine an Appropriate Shift Work and Reduce the Fatigue Level of Shift Workers, the study of the shifting times in the work shifts is good to reduce the level of fatigue suffered by the workers will be discussed in the next research.

2. METHODS

This review only discusses journals with cross-sectional research design that aims to compare the level of fatigue in shift workers. A cross sectional study design, also known as a prevalence study, is a study using a design that the characteristics of all measurements of all variables are studied at the same time. Cross sectional study design has advantages that are easy to implement, the research results can be obtained, it can explain the relationship between health phenomenon studied, it is a preliminary study of a design of a case, control, and cohort studies. The research method used in 11 journals which study the population was random sampling method. Among the 11 literatures, 4 literatures are analytical surveys and the 7 others are analytic observations. The data in this literature study were collected through interview, questionnaire, measurement of fatigue with reaction time, and speed and accuracy test of boundor Wiersma. Relevant journals from all articles with the keyword of "shift worker risk analysis", then continued with the word "comparison of the fatigue levels of shift workers". After the search, the authors found a number of journals that were then selected again

according to the relevance to the title of the 11 journals prior. The variables used in the journal, that were used as the literature studies, are:

• Independent variable (Shift work)

The independent variable, a variable that caused the occurrence or change of the dependent variable. The independent variable in this research was work shift. Shift work in this literature study has several variants but can be generally classified into morning work shift, afternoon work shift, and night work shift.

• Dependent variable (Work fatigue)

The dependent variable was the variable that was influenced or became the result of the independent variable. The dependent variable in this study was work fatigue. Work fatigue is a condition in which workers experience exhaustion or fatigue during or after working resulting in the decreased of the physiological function of the body so that the workers' performance decreased. Work fatigue in this literature study was studied through reaction measurement by using reaction timer tool, questionnaire (with scores) and speed and accuracy test of boundor Wiersma.

• Nuisance variables

The nuisance variables were variables affected the relationship between the independent variable and the dependent variable. The nuisance variables in this study were controlled nuisance variables:

• Controller variable is under control

• Age

Age, is the period since the workers were born until the time of their data taken through the questionnaire.

• Gender

The term distinguishes between men and women based on their physical and biological characteristics as measured by questionnaires

• Uncontrollable disturbing variable

• Nutrition Status

The health and work force are closely related to one's nutritional level. Nutritional status can be seen from the body mass index calculated from the body weight divided by the height of the squared obtained from the questionnaire.

• Working Period

The time calculated from when the workers started working in the companies and obtained from the results of the questionnaire.

• Illumination

The amount of light in lux units sourced from natural and artificial lights measured by luxmeter.

• Noise

The unwanted sounds coming from various sources (machines, etc) measured by sound level meter devices.

• Working climate

The size of the wet bulb temperature index as measured by the heat stress area of the monitor.

• Workload

The number of jobs that became the tasks of the employees. Workload can be eliminated in this study because all of the samples in the population get the same workload.

• Health condition

Health condition was closely related to the employees' performance. The health condition was measured by the history of the diseases suffered by the employees.

• History of Chronic Disease

A gradual and a long course illnesses which were discovered from the interviews and questionnaires.

3. RESULTS AND DISCUSSIONS

The first study that used research analytical survey with cross sectional approach was done in textile companies. This study measured the differences in work-related fatigue between the morning shift, noon shift, and night shift on the employees in the production department. This study was conducted by taking a questionnaire of 62 respondents with fatigue in the form of scores (low, medium, high, and very high). The applicable shift rotation system was 3-3-3, where every shift was done for 3 days and the days off only on Sundays. The result of fatigue difference test based on the work shift showed a tendency that the night shift tended to cause very high fatigue. In the first journal, although the data were not taken directly, which were only in the forms of questionnaires, but they could provide an overview of the difference in fatigue suffered by the workers of the morning and afternoon shifts. From this study, it also could be seen that the workloads for each worker in the operation department were the same.

In the second study which the type was analytical observation with cross sectional approach was done in winding companies that process raw material into pattern or batik printing clothes. This study was only conducted on female workers. The data were collected through questionnaires and through the measurement of work fatigue with the reaction time with statistical test for one way anova questionnaire and kruska walls test was implemented to study the work fatigue. When the results were compared to the reaction time, it can be said that the highest level of worker fatigue was followed by the afternoon shift and last morning shift where

the rotation of the shift system changed after one week. In the second research, the combination data were collected, i.e. the questionnaire (for the nuisance variable) and measure the reaction time of the dependent variable. Through this study, the authors found that the workloads were the same for all of the operators.

In the third study, the analytic observation type was used with cross sectional approach implemented in the Refinery Control Central Room (RPPK) of petroleum processing companies in Balongan Indramayu. This research was done by collecting data from the forms of self identity and the measurement of work fatigue level by using KAUPK questionnaire. After the measurement of work fatigue between the morning shift, afternoon shift, and night shift, the result derived were that there was no difference of fatigue level between the morning shift and afternoon shift workers, there was no difference of fatigue level between the afternoon shift and night shift workers, but there was significant difference of the night and morning shift workers where the night shift workers' fatigue was greater than the morning shift workers. The rotation of the work shift system in this research was 3-3-3 where every shift was done for 3 days. The third study, although the direct data was only collected through a questionnaire, but it could give a general overview of the difference in the fatigue suffered by the early morning shift, night shift, and night shift workers, which the shift with the highest level of fatigue was suffered by the night shift workers.

The fourth research with the type of analytical survey research with cross sectional approach was conducted at oil palm companies in Jambi. The data retrieval in this study is only done by measuring the reaction time. This research used the T-Test statistic test. The conclusion of this study was that there was a significant difference in work fatigue between the morning shift and night shift workers which the night work fatigue was greater than the morning shift. The prevailing rotation for this companies was 2 shifts daily, each shift lasted for 12 hours, with the weekly rotation where the workers work fully for 12 hours on Monday to Saturday and 8 hours on Sunday. The fourth research only retrieved the reaction time data and was only done during the morning shift and night shift. This study directly concluded that the work fatigue on the night shift was higher than in the morning shift.

The fifth research with analytical survey type research with cross sectional approach was done in the wrapping department of herbal medicine companies. The data collection in this research was done by measuring the reaction time and distributing questionnaires. This study used Wilcoxon statistical test. The conclusion of this study was that there was a significant difference in the fatigue suffered by the morning shift workers and the night shift workers which the night shift workers' fatigue level was higher than the morning shift workers, the fatigue suffered by the morning shift workers was more moderate, while the night shift workers suffered from more severe fatigue. There was no information on the shift rotation in this fifth study. The fifth study carried out the data of the reaction time and questionnaire done at the morning shift and night shift. This study directly concluded that the work fatigue suffered by the night shift workers was higher than the fatigue suffered by the morning shift workers.

In the sixth study that used analytic observational research type with cross sectional approach was implemented in a hospital. This research was done by collecting the research data obtained through data forms of self identity and measurement of work fatigue level using KAUPK questionnaire. This study resulted in data that the highest level of work fatigue felt by the night shift because they experience sleep disturbance and had longer working hours than other shifts. The rotation shift system applied was 2-2-2 where the shift was implemented for 2 days as after 2 days of night shift the workers could take a rest for 2 days. The sixth research, although the indirect data was only taken through a questionnaire, but it could provide a general overview of the difference in the fatigue level in the morning shift, afternoon shift and night shift, which the highest level of fatigue shift was in the night with the greatest fatigue rate compared to other shifts.

In the seventh study the analytic observational research using cross sectional approach was implemented, it was conducted at daily check of land transportation companies. This research was done by collecting research data obtained through a questionnaire. The research concluded that there was a relation between work shift with the work fatigue and the workers who experience high work fatigue was the night shift workers. The rotation applied to PT. Kereta Api Daerah Operasi VI Yogyakarta Dipo Kereta Solo Racing was 3 shifts every one week.

In the seventh research, although the data was just taken through a questionnaire, but it could give a general overview of the difference in fatigue level in the morning shift, afternoon shift and night shift workers, which the highest fatigue level was in the night shift, with the highest fatigue level compared to other shifts.

In the eighth research with analytic observation type research with cross sectional approach was done in the weaving companies that process raw material raw material into pattern or batik printing clothes. The eighth study was conducted in the same companies as the second but was conducted on different departments. This study was only conducted on female workers. This study was conducted through a questionnaire and the measurement of work fatigue with the reaction time with statistical test for one way anova questionnaire. This study resulted in the conclusion that there were significant differences in the work fatigue between the morning, afternoon, and evening shifts, as well as the fatigue in the morning and afternoon shifts were still in the category of light work fatigue while in the night shift was categorized as moderate work. When it was compared to the reaction time it could be said that the highest level of worker fatigue was followed by the afternoon shift and last morning shift which the rotation shift system changed after one week.

In the eighth study, the combined data were collected through questionnaires (for the nuisance variables) and measure the reaction time for the dependent variable. The interfering variable in this study can be controlled, so the ratio of the treatment to the sample population was equal to the level of work fatigue referring to the reaction time. In this study, it was noted that the workloads are the same for all of the operators.

In the ninth study used analytic observational research type with cross sectional approach was done in the hospitalization room of the hospital. This study was conducted through a questionnaire and with the measurement of work fatigue with reaction time with chi-square statistical test. This study resulted in the conclusion that there were significant differences in the work fatigue between the morning, evening, and night shifts, and the highest fatigue felt by the nurses in the morning shift due to the number of activities performed by the nurses in the morning while at night the nurses had bedtime only when the patients asleep and the nurse

work was easier because there were helps from the nursing staff and some students who had a an internship practice there. There was no information about the rotation shift system. In the ninth study, combination data were collected, i.e. questionnaire (for the nuisance variables) and measured reaction time for the dependent variable. This study had anomalies with the highest fatigue of morning shift due to the dense work of nurses in the morning shift, while at night the nurse had sleep time while the patient asleep and the nurse job got helps from the nursing staff and some students who had an internship practice there.

In the tenth research used analytical survey type with cross sectional approach done in the production department of PT.X Semarang beverage factory. This study was conducted by measuring work fatigue with speed and accuracy test of the Bourdon Wiersma. This study resulted in the conclusion that the highest work fatigue experienced by the night shift workers followed by the afternoon shift and morning shift workers that were measured by the speed and accuracy of the Bourdon Wiersma test before and after the work which the lowest speed and accuracy rate was on the night shift. The rotation shift system changed after one week.

In the eleventh research used analytic observation type research with cross sectional approach done at a gas station operator in a gas station. This research was carried out with questionnaire, interview, heart rate measurement (for work load), and work fatigue measurement with reaction time with cramer coefficient C test test from the stastistic test. This research resulted in the conclusion that there was significant difference in the work fatigue between the morning, evening, and night shifts, as well as the highest fatigue felt by the afternoon shift workers due to the number of vehicles that recharge their fuel in the afternoon. The applicable shift rotation system was 3-3-3, which every shift was done for 3 days with 3 day shift pattern, 3 day shift, 3 night shift, and one day off.

Of the 11 research journals studied, it can be said that there was a difference in the level of fatigue between morning shift, day shift, and night shift workers with the highest level of work fatigue perceived by the night shift workers (noted from the morning shift, afternoon shift, same night shift workloads). The night shifts often cause physiological disorders (low sleep

quality, decreased physical and mental capacity, gastrointestinal disorders), physiological disorders, and performance disorder [17].

An effect of working in the night shift was the occurrence of performance disturbances. This can be understood, because working at other times of sleep or otherwise would change the body's natural function. To perform a good job (though not maximum) was through a long process of adaptation and acclimatization [17]. Meanwhile, according to the Institute for Work & Health that also conducted a research from 18 studies that there were unintended consequences for workers outside the normal shift (morning) that resulted in disruption of internal body clock, fatigue, sleeping difficulties, disturbed appetite and digestion, addiction sedative, disturbed in social life that ultimately affects performance, increased the likelihood of errors and accidents in the workplace. Shift work could also exacerbate the existing health problems such as diabetes, asthma, epilepsy and psychiatric illness [14].

4. CONCLUCIONS

There was difference of fatigue level between morning shift, afternoon shift and night shift from 11 researches which had been done, it could be concluded that the shift with highest work fatigue level was the night shift which the work load traversed to the sample population was the same, the anomaly that happened was that the highest work fatigue was suffered by the morning shift and afternoon shift because the workloads through the morning shift and the afternoon shift were heavier than the night shift.

5. RECOMMENDATION

For the workers involved in the shift system, they are advised to arrange the best possible sleep patterns to reduce the fatigue level in work and the companies should provide them a rest room.

For companies that perform work shift system, they are suggested to remodel the shifts according to the level of work fatigue where after the night shift (with the record of all shift workloads equals) the workers are given rest day.

For further research, it is expected to summarize more journals for literature studies that the studies are related to the work shift and fatigue.

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EMERGENCY RESPONSE SYSTEM IN PT X BASED ON NFPA 1600 EDITION 2016

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Abstract

All companies from various sectors are required to plan, implement, and manage a good and well-planned emergency response system program. PT. X is an Engineering, Procurement, and Construction (EPC) company with an Occupational Health, Safety, and Work Environment guideline that refers to SMK3 OHSAS 18001:2007. This study describes the compatibility of the emergency response system in PT.X with NFPA 1600 Edition 2016. This is a qualitative descriptive analytical study through the use of semi-structured interviews, document review, and direct observation of the studied location. The results show that for the six elements of the NFPA 1600 Edition 2016, the total average of compatible categories is 89.59% while the average percentages of incompatible and not applicable categories are 1.59% and 8.87%, respectively. It is recommended to better maintain and manage the emergency response system by satisfying all required elements in NFPA1600 Edition 2016.

Keywords: Emergency Response System, EPC, NFPA 1600 Edition 2016

1. INTRODUCTION

The globalization era continues to grow rapidly and significantly, pushing all companies to increase their productivity and quality and, at the same time, pay attention to work efficiency. This leads to the use of modern technology, hazardous materials/raw materials and very complex work processes which, if not managed properly, certainly creates a high possibility of emergency situations and accidents due to the presence of potential dangers and major risks. The rate of occupational accidents in Indonesia tends to increase every year. In 2011, 9,891 cases were recorded. This number increases dramatically in to 21,735, 35,917, and 24,910 in 2012, 2013, and 2014, respectively. (Data and Information Center of the Ministry of Health, 2015)

Many cases of occupational accidents and disasters are results from poor emergency response implementation and management that causes various losses. Therefore, all companies are required to plan, implement, and manage an emergency response program as a good and well-planned system. This emergency response often aims to isolate the source of danger and secure other areas from the spreading effect of the source of danger into a broader area. The objective of this study is to assess the implementation of emergency response system in companies. The reference used for assessing the company's emergency response system is the 2016 Edition of the National Fire Protection Association 1600 (NFPA 1600) [2]. NFPA 1600 is an important tool to respond and improve an emergency response program because it consists of the best instruction to establish a comprehensive program [1]. Based on the 2016 Edition of NFPA 1600 there are six stages that have to be performed in establishing an emergency/disaster management program: management program, planning, implementation, training and education, exercise and test, and program maintenance and improvement.

2. METHOD

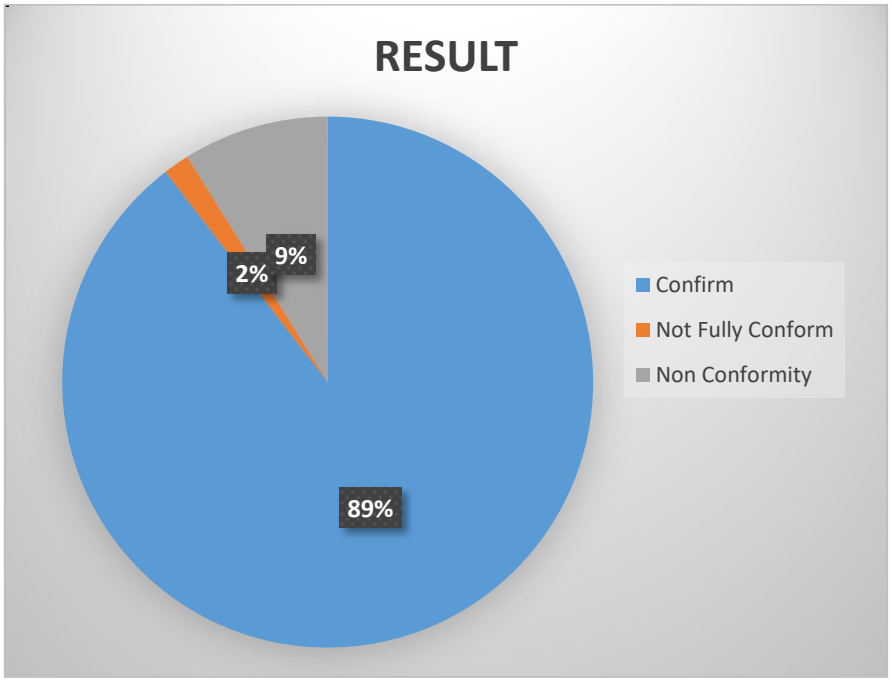
This study was conducted during the period of June–July 2017. This is a quantitative descriptive analytical study on two informants, i.e. health, safety, and environment manager and area supervisor. Data collected were primary and secondary data which were collected through in-depth interviews in a focus group discussion format. In addition, direct observation and document review were also performed to assess the validity of the results of the interview to be able to meet the principle of triangulation in a qualitative study. The instruments used in this study were interview guideline and observation sheet in the form

of a self-assessment tool for conformity checklist released in the 2016 Edition of NFPA 1600. The analysis of the data was performed in an univariate manner through content analysis.

3. RESULT

Interview using focus group discussion technique with the informants on the implementation of the emergency response system based on NFPA 1600 was performed, followed by direct observation and company document review to get the conformity proportion of the company's emergency response system to NFPA 1600. The total average of conformity of the emergency response system implementation in PT X to the NFPA 1600 was around 89.59% and the total proportion of the elements that are not fully conform to NFPA 1600 was around 1.59%. The nonconformity proportion was bigger than the conformity proportion or not fully conform, which was around 8.87% (Figure 1).

Figure. 1 Result of Implementation NFPA 1600 Edition 2016 in Company

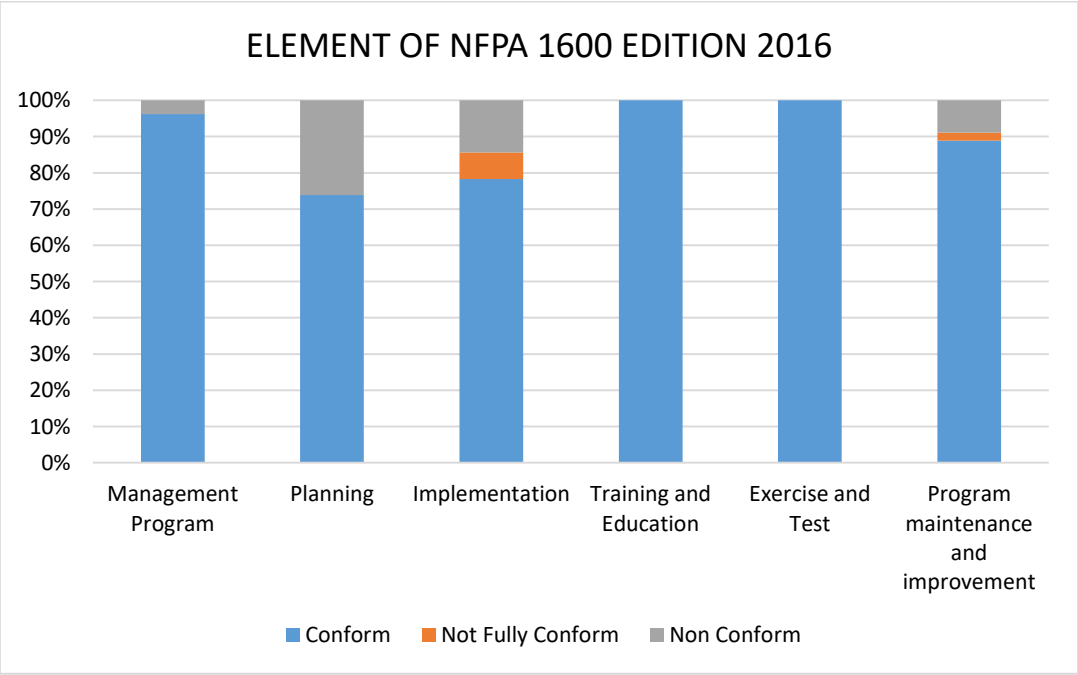


4. DISCUSSIONS

Based on the 2016 Edition of NFPA, there are six elements in the implementation stage of emergency/disaster response management. The first element is Program Management which relates to the commitment of the company, starting from the organization to resource allocation and activities to establishing a legal framework is. The second element is Planning that emphasizes on process, analysis, need assessment, and target. The third element, Implementation, is a clear description of a company's condition towards the

emergency response itself. The fourth element, Training and Education, sees the strengthening of human resource, both in the company and around the company. The fifth element, Exercise and Test, focuses on the formulation of methodology and various evaluations to strengthen the resources in the company. The last element, Improvement and Maintenance, aims to improve the program so that the company will still be able to run well despite of any adverse events it experiences.

Figure. 2 Six Element NFPA 1600 Edition 2016



Based on the results in Figure. 2, it is apparent the company had put efforts to implement various requirements of each element in the 2016 Edition of NFPA 1600. However, there were still some requirements for emergency response system in the 2016 Edition of NFPA 1600 that were not implemented yet, starting from those that have been programmed but not yet run to those that were completely missing from the program. This condition leads to an assessment result of partially conforming or non-conforming. The company had performed training and education the best possible to meet the requirements of emergency response training and education element of the 2016 edition of NFPA 1600 that it achieved a perfect score (100%) as measured in the conformity proportion. Another perfect score was achieved in the exercise and test points, as measured in the conformity proportion for this element. Despite the two perfect scores in two elements, the score in

the planning element conformity was 73.9%. The company needs to understand the importance of planning. Meanwhile, other elements had not met the requirements for the 2016 Edition of NFPA1600.

In terms of planning in strengthening the emergency response, the thing that is very much needed by the company is risk assessment [3]. Yet, it is clear that emergency response planning is an important step to overcome anything that may happen anytime that with good planning, fatal disaster can be avoided. The point that has the lowest score in the planning element was the risk assessment point with a percentage of 32.26% [6]. This point is certainly vital because in risk management, the risk assessment very much influences the determination of impact or exposure to potential dangers because through risk assessment, occupational accidents can be prevented or eliminated.

In the implementation, the results obtained was 78.3% which was the second lowest value. It is very surprising that the mitigation point was 0% [4]. Surely this is very shocking because mitigation is important in the management of disasters/emergency situations (Susanto, 2009). The second point in the implementation element that also received low score of 66% was crisis communication and public information. Hence, it is urgent that the company should increase them as soon as possible [5]. This relates to the fact that communication is needed in the disaster management system starting from the planning, mitigation, emergency response, to rehabilitation processes.

Competing interest

This study was conducted as a contribution to the world to depict the emergency response system in EPC companies in Indonesia. The instrument used was the 2016 Edition of NFPA 1600. The author declares that there is no other interest or personal or group ego to take advantage or discredit any party through this study.

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Study about Factors that become Obstacles in the Implementations of SMK3 in Construction Services Industry

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Abstract

Construction works are activities that are very complex, multidisciplinary science and involve a lot of abusive labor with relatively low education, operating in open land with the threat of heat, rain and wind, and interact simultaneously with various heavy equipment in a limited field so it has the potential to invite high hazards threatening the safety and health of workers.

The construction industry is the largest contributor to accidents followed by manufacturing, transportation, mining and forestry. Therefore, the government does not cease socializing the implementation of SMK3 on any construction work under the auspices of the Ministry of Public Works and Housing

This research was conducted to find out the factors inhibiting the implementation of SMK3 in construction projects and then concluded the most dominant factor in the implementation of SMK3 in the construction projects.

This research uses data collection method which is done by field observation which ended with interview method for filling tabulation data that have been prepared. The most important

documentation used in this research include documentation of Monitoring and Evaluation results of the implementation of SMK3 in Construction Project.

In this research, it is indicated that the factors that become obstacles of the application of SMK3 are : cost factors 51%, skilled human resources factors 14% and awareness factors of workers and management of the company itself 35%.

Keywords: OSH, Construction Services, SMK3

1. INTRODUCTION

The construction service industry is an industry that includes all parties involved in the construction process, including professionals, construction executives and suppliers who jointly meet the needs of actors in industry [1]. Construction service industry is one sector of industry that has a high risk of accidents in Indonesia.

Construction activities contain many hazard elements with high risk levels of accidents, whether happened to labor involved in construction work and the community in the neighborhood of construction works. Negative impacts arising from the construction process is the emergence of accidents due to work. This is because the works of construction services is almost always in the open field and has the ease of access for entering by many people, where conditions are not support for occupational safety and health so that potential for the occurrence of accidents [2].

From the data on the proportion of occupational accidents in Indonesia it is known that in 2010 the highest number of occupational accidents is in construction service sector (31.9%) followed by manufacturing industry (31.6%), transportation (9.3%), mining (2, 6%), forestry

(3.8%), where the data is still 50% of the actual amount because the data is still obtained from the number of claims against Jamsostek [3].

SMK3 (Occupational Safety and Health Management System) is part of the overall management system that includes the organizational structure, planning, responsibility, implementation, procedures, processes and resources needed for the development of the implementation, achievement, review and maintenance of occupational safety and health policies in the context of risk control related to work activities for the creation of safe, efficient and productive workplaces [4]. SMK3 is a more responsible system in trying to create a safe, healthy and prosperous working environment and free from accidents and occupational diseases [5].

There are several obstacles in the implementation of SMK3 in construction projects, among others : lack of involvement and cooperation of workers in the planning and implementation of SMK3 on construction projects, weak commitment of companies in implementing SMK3 on the ongoing project, the system applied not in accordance with the needs of companies and lack of experts in the OSH field within the company.

2. METHODS

This research was conducted to find out the factors inhibiting the implementation of SMK3 in construction project and then concluded the most dominant factor in the implementation of SMK3 in the construction project.

This research uses data collection method which is done by field observation which ended with interview method for filling tabulation data that have been prepared. The most important

documentation used in this research include documentation of Monitoring and Evaluation results of the implementation of SMK3 in Construction Project.

The provinces that being the subject of this research is : North Sumatra Province. The first step is to identify and propose projects within the Ministry of Public Works and Housing of the Province of North Sumatra to be reviewed, and then prepare a work plan for monitoring the implementation of SMK3 construction for the projects. After that, monitoring fulfilled by placing SMK3 experts on the projects. There was two experts accompanied by three assistants and six surveyors. Researchers and teams came to each project site and distributed a list of questions to the respondents to fill in.

There are about ten projects reviewed in this research with contract values ranging from Six Billion Rupiahs to Thirty Six Billion Rupiahs, among others : Kabanjahe Kutabuluh Road Widening Project, Kutabuluh - Lawepak Road Extension Project, Improved Road Structure of Kapten Sumarsono Medan, Development Project of Primary Network of Waste Water Zone 11, Infrastructure Development Project of Slum Areas Section Deli Medan Belawan Subdistrict Medan City, Optimization Project IPA Martubung / Medan Deli, Percut River Climbing Project along the 275 meters Deli Serdang District, Project Retrograde River Deli along 260 meters Medan City, and Flood Control Infrastructure Development Project around Kualanamu International Airport Deli Serdang Regency.

3. RESULTS AND DISCUSSION

In this research, it is indicated that the factors that become obstacles of the application of SMK3 are : cost factors 51%, skilled human resources factors 14% and awareness factors of workers and management of the company itself 35%.

For hazard identification, risk assessment and control, the RK3K document has been created, but its content and its applicability is sometimes inappropriate and more often than not done. For common K3 aspects, its implementation is still not done, financing needs to be explained in detail and awareness. For aspects of competence, training, and awareness, level of consciousness is still low. Training and upgrading of competence is still not done much. Officers and Occupational Health and Safety expertise are still lacking and not in accordance with the needs of the project and the Minister of Public Works. For communication, participation and consultation, communication is good enough. Several banners and posters and information media have been installed and used according to project needs. Conduct periodic consultations with OSH experts and community support around the project. For aspects of use of work tools, in the use of tools adjusted to the type of package or work has been done, but there are still conditions in which the equipment operators do not have a license (SIO). There are also packages in which the tools used are not well maintained, performing any device calibration test and checking the tool before use. And then for Occupational Safety and Health, there are still many projects that do not apply Occupational Safety and Health aspect in every job implementations so that many unsafe conditions and even the possibility of accident.

4. CONCLUSION

Companies generally feel overwhelmed with the implementation of SMK3 because they must incur additional expenses for the needs of implementing SMK3 on their ongoing projects. Whereas on the contrary, the implementations of SMK3 precisely saving companies expenses because by the implementation of SMK3, companies are not burdened with the cost of accidents or health workers. A healthy worker can increase the company's productivity.

Acknowledgments

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Tables

Table 1. Ranking Analysis of the Overall Reviewed Construction Projects

No.	Factors Inhibiting the Implementation of Occupational Safety and Health Management System (K3)	Percentages	Ranking
1	Does the organization of SMK3 training from companies to form HSE experts affect the implementation of SMK3 in the field?	14%	3
2	Does the budget procurement for the implementation of SMK3 in construction projects affect the company's profit?	51%	1
3	Does the implementation of SMK3 properly and correctly affect the workers in doing their work in the field?	35%	2

Table 2. GAP Analysis Checklist for SMK3 Implementation on Reviewed Projects

No	Target Packages Name	Contract Values	Results			Accumulated Progress until September 2017
			RK3K		GAP (Values)	
			Yes	No	%	
1	Kabanjahe Kutabuluh Road Widening Project	Rp. 36.208.573.400	√		91,5%	100%
2	Kutabuluh - Lawepak Road Extension Project	Rp. 29.358.091.961	√		85,5%	100%
3	Widening Jamin Ginting Road (Medan)	Rp. 18.093.816.663	√		87,6%	100%
4	Improved Road Structure Kapten Sumarsono (Medan)	Rp. 17.470.620.000	√		50%	100%
5	Construction of Primary Wastewater Water Zone	Rp. 31.000.000.000	√		51,7%	100%

	Network 11				
6	Infrastructure Development of Slum Settlement Area Bagan Deli Kec. Medan Belawan Medan City (Continued) (Kota - Medan I)	Rp. 11.509.280.000	√	65,9%	100%
7	Optimization of IPA Martubung / Medan Deli	Rp. 6.249.938.000	√	7,3%	100%
8	Strengthening River Cliffs Percut Throughout 275 M Kab. Deli Serdang	Rp. 3.220.149.900	√	63,8%	100%
9	Retrofitting Deli River Throughout 260 M Medan City	Rp. 7.309.467.000	√	14,3%	100%
10	Pembangunan Prasarana Pengendalian Banjir di sekitar Development of Flood Control Initiative around Kuala Namu Airport Deli Serdang Regency (Continued)	Rp. 16.740.537.000	√	32,1%	100%

DEVELOPMENT OF FIRE INDICATOR IN GRINDING AREA AT XYY FACILITY

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Abstract

Accident by Fire has been one of the accident mostly dangerous happened in industrial world. This research was took a place in XYY facility which produce a lifeboat deck extension between 2011 to 2012 and the company has a total 120 employees. The facility normally does fire drill 4 times every year and utilizes a Fire Alarm as a fire accident sign. During the drill, the employees need 6 minutes 15 seconds for them to arrive at assembly point and the group of employees from grinding process, which has 18 employees, has always the last group that arrived. Grinding is an abrasive machining process that uses a grinding wheel, the aim is to eliminate sharpen edge after steel cutting process. During the process, it would create a loud noise. Earplug has equipped to workers in order to reduce noise injury.

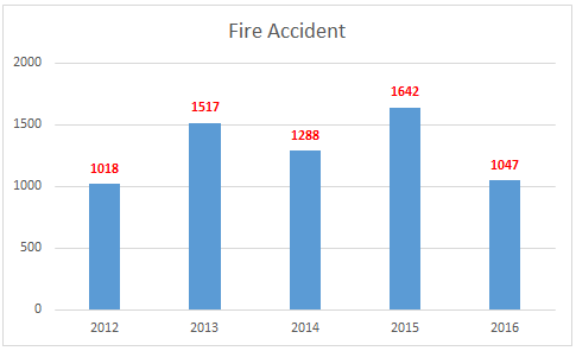
By using a questioner, the researcher will be observe what is the basically issue that has happened inside grinding room. Then we can find what is the most problem why they always the last group that reached safe area. The outcome indicated that they couldn't hear enough of Fire Alarm. The company then try to developed another fire sign indicator so that the grinding worker will immediately response after fire sign executed. We tried using Blitz Lamp, the Lamp will go on and off simultaneously in high intensity discharge of light. The next fire drill showed after applying the Blizt Lamp, when the next Fire drill held, the time of evacuation took 5 minutes 20 seconds until all the employees arrived in the safe place and the grinding worker was not anymore the last group that arrived.

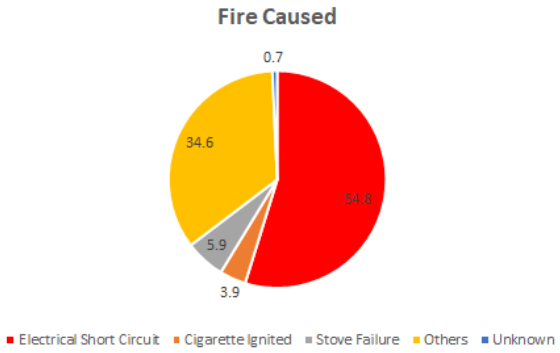
Keyword: Light Fire Sign, Fire at Grind Area, Visual Alarm Fire

1. INTRODUCTION

As we knew, fire is one of accident that mostly dangerous in industrial world. It will contribute to loss of human life and uncountable damage of property, also other things such as falling down of company's image, profit gain, stop production etc. From all of those losses, losing human life is the most important things must to be avoid in other word immediate human evacuation must be the first thing to execute when accident happened.

In Jakarta itself, as we see from graph below, at least 1.000 fire accident take place every year and more than 50% caused by electric short circuit [1].





There are many activities in terms of Emergency Response Preparedness (ERP) required in preparing human resources and organization to carry out activities in an emergency or disaster situation. The activities include the formulation of emergency plan and procedures, ranging from supporting tools and resources that aim to save lives and minimize property damage. NFPA or the National Fire Prevention Association 1600 is a standard that provides instructions to build, run, and evaluate disaster/emergency management and business continuity programs [3]. **This research only focusing in how to minimize of human life killed during the accident, by reducing the time of escape**.

XYY company is a manufacture facility, where they produced life boat deck extension . The material that they used 90% steel . The company has 120 workers in total and 18 of them work

at grinding operation. The facility equipped with Fire Alarm as a warning stage as a sign information to the employees when Fire accident has happened.

An emergency alarm and evacuation system for directing persons to an emergency exit. The system includes an alarm, a plurality of indicator units arranged in a line toward the emergency exit, and an operating unit coupled to the alarm and being operable in response to an output signal from the alarm to successively energize the indicator units in the direction of the exit [4].

Grinding process is a machining process which utilize hard abrasive particles as the cutting medium and shaping surface material [5]. The grinding force is generated by the grinding wheel rotating at high speed on the grinded metal. This force excites both the grinding wheel and the grinded metal which can generate noise and vibrations. Noise and vibration of handheld grinders is one of the most important health and safety problems at work in metal workshops. The sound pressure levels of the grinding process are much higher than 90 dB(A) at the operator and the generated hand arm vibrations (HAV) can cause serious diseases like "vibration white fingers" [2]. Indonesia regulation has declared that noise threshold limit is 85 dB(A) [6]. In order to meet that requirement, during the process, the worker equipped with ear plug. Beside it the area of grinding is isolated to prevent debris that produced by the process comes out from the area.

Metal grinding and cutting.

2. METHODS

This study is a descriptive study, data were collected through interviews with all worker at grinding process area and the observations conducted directly in the location. The researchers

used a stopwatch-timer to calculate time of evacuation before and after the experiment. The study had been conducted from 2011 to 2012.

3. RESULTS

The company exercising fire drill 2 times in a year. In 2011, when fire drill held, all employees took 6 minutes 15 seconds for them to arrive to safe area. By a chance, the group of employees from grinding process was always the last group that arrived. The researcher thought at first, whether they did to tire since they are work in the hardest process or there is other problem that slowing them. The details time see table below :

Escape Time 2011

	No of workers	1st Semester	2nd Semester
Office workers	20	5 minutes 18 seconds	5 minutes 19 seconds
Warehouse workers	14	5 minutes 22 seconds	5 minutes 20 seconds
Maintenance workers	6	5 minutes 15 seconds	5 minutes 12 seconds
Welder workers	8	5 minutes 21 seconds	5 minutes 22 seconds
Assembly workers	22	5 minutes 21 seconds	5 minutes 19 seconds
Paint workers	12	5 minutes 17 seconds	5 minutes 18 seconds
Grinding workers	18	6 minutes 17 seconds	6 minutes 15 seconds

As we can see that grinding workers was the very last group that arrived at the safe area, they are almost 1 minute away behind form other groups.

4. DISCUSSIONS

In order to find out the big issue, the research examined the area of grinding process and the worker. After examined the grinding room, the researcher can't discover anything wrong such as the doors hard to open or there are part that blocked escape route, then researcher started to interview all worker in grinding area, the objective was to know why they slowed in escape time compared with other worker in the other area. They answered that 90% of them was they

couldn't hear enough the sound of Fire Alarm. They only knew that the other group was ran out from their window glass so they ran also following them.

The audible alarm method as a means for alerting persons having impaired hearing of course is, in most cases, ineffective and unsuitable. As means of addressing this problem, numerous alerting systems have been developed to rely on other indicators more readily noticed by the persons to be warned. An improved actuator device is disclosed which comprises a combination of indicator light for providing an alarm to those persons of impaired hearing [7].

The company additionally installed a Blitz Lamp inside the grinding room. The mechanism of this Lamp is it will go on and off simultaneously in high intensity discharge of light and working along with Fire Alarm when fire accident happened.

In 2012, the facility running the first fire drilled that blitz lamp was installed inside the grinding room and then did it one month after it again. As the result we can see below :

Escape Time 2012

	No of workers	January	February
Office workers	20	5 minutes 19 seconds	5 minutes 21 seconds
Warehouse workers	14	5 minutes 21 seconds	5 minutes 22 seconds
Maintenance workers	6	5 minutes 14 seconds	5 minutes 13 seconds
Welder workers	8	5 minutes 23 seconds	5 minutes 23 seconds
Assembly workers	22	5 minutes 23 seconds	5 minutes 21 seconds
Paint workers	12	5 minutes 18 seconds	5 minutes 19 seconds
Grinding workers	18	5 minutes 19 seconds	5 minutes 20 seconds

5. CONCLUSIONS

Since the blitz lamp been used as an indicator of fire accident the grinding worker was no longer the last group that arrived in safe area. The indicator lamp worked successfully as a trigger to human response in sensing a specific condition by visualization. The results showed what is the most effective fire tool relating the human senses in the specific area such as grinding process room. This can be seen by the increased of their time speed when escaped.

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RISK ASSESSMENT AT INSTALATION COMPRESSOR COMPANY : PRE ELIMINARY STUDY TO IDENTIFY MAJOR HAZARD IN THE WORKPLACE

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Abstract

Each workplace has a potential hazard and risk that can causes accident which impact to personal injury, illness until property damage. Therefore, it is a mandatory to carry out risk assessment of the work activities. This study conducted at installation compressor Machine Company in large scale where it had not conducted risk assessment yet. The aim of this study was to identify major hazard and analyse risk. The method was survey of work environment, inspection and in depth interview to all of responsible area. Risk assessment method of this study was used risk matrix refer to standard of AS/NZS 4360: 2004. The results founded several hazard such us potential fire, material fall down from a height and expose to the worker, punctured a sharp object, and struck by heavy equipment. The lack of knowledge workers on occupational health and safety is also founded in this study. In according with processing of data, it was found score of high risk namely potential of fire with risk index score was 20 and lifting heavy equipment manually with the risk index average score of 16, followed working at heights as well as the equipment which is still minimal with the risk index average of 12 and the lifting work with the risk index 12.

Keywords : Identification, compressor, hazard, Risk, risk index

1. INTRODUCTION

The occurrence of workplace accidents and occupational diseases is a common problem faced by all industry in Indonesia. Data from Social Security Agency Employment (BPJS Ketenagakerjaan), until the end of 2015 showed that in Indonesia have occurred as much as 105.182 cases of occupational accidents. The number of major accidents that resulted in

fatality cases is as much as 2,375 cases. This figure does not include other costs borne by the company or by the victim's family. So that the cost of loss caused by workplace accidents is often illustrated as a phenomenon "iceberg". Phenomena "iceberg" is described as chunks / ice mountain that looks at the sea surface is smaller than the overall size of real ice. This means that in a work accident, the "visible" loss is less than the overall loss [6]

Occupational accidents in Indonesia occurred in nearly all types of industries. The problem is Not all industry players eager to implement health and safety optimally. The lack of awareness of the importance of the implementation of occupational health and safety is still a central issue of employment. Therefore it is important to continue to developed and introduced on occupational safety and health of this whole business entrepreneurs start from large scale businesses to small scale industries including compressor machine used almost universally across all industrial scale.

Compressors is a mechanical device which serves to increase the fluid pressure of gas or air. The aim to increase pressure is to be able to flow or process needs in system in larger process. Application air compressor is used for filling the tire, clean the engine parts, provide air supply to the combustion process in the boiler / electric motor, and for process of painting with a spray apparatus. In the other side, the compressor is also widely used for tools that use pneumatic system [5]. In the compressor industry is also expose hazards and risks Occupational health and safety that need to be identified and controlled. this process is known as risk management safety and health.

Risk management is an effort to manage the risk of occupational safety and health to prevent unwanted accidents with comprehensive, planned, and structured by system. Risk management associated with hazards and risk that occur in the workplace that may result in losses for the company. If not controlled, the risk can threaten the survival of the company. [1]

The Literature and journals that discussed the hazard identification and risk assessment on the machine installation industrial compressors was not commonly founded in occupational safety and health journals in Indonesia. In the other side, studies of hazard identification and risk assessment in this compressor installation company is also the first study conducted formulated comprehensive. Some of work accidents have occurred in this compressor industry so that it is a sufficient to be consideration in reviewing early to analyze the risk and major hazard in industrial compressor installation company.

The aim of this preliminary study was to determine the general description of the hazard and risks of each work process, analyze level of knowledge and understanding of occupational safety and health that affect work performance and risk, and determine the level of occupational safety and health risks of each of the work process. This study is a preliminary study to the next can be used for more in-depth study due to limitation of time and resources. A limitation of this study is only on the stages of storage, preparation and installation of the compressor in the factory. For the use of the compressor and its derivative functions that causes hazard and risk was not discussed in this study. This study is important to be able to determine the next step or study so that the necessary resources are more effective and efficient

2. METHODS

Design studies were used in this studies are descriptive study. The process of this study was collecting the symptoms and facts. It were founded during the walk-around inspection and in-depth interviews to some of responsible person area in the job site. Data and information is also processed and subsequently analyzed using a type of qualitative risk analysis with the standard AS / NZS 4360: 2004 Standard is commonly used by many industry in conducting risk assessment [3]

In this study, the Author determined level of risk from all the steps and activities so that the major hazard as Main purpose of this research can be explored. Analyze level of Risk was using combination probability (Probability) with impact (Consequences). Standard used by AS / NZS 4360: 2004 can be seen in Table 1, Table 2 and Table 3.

The process of risk analysis to determine the level of risk using a worst case scenario. It means that potential hazards analyzed without treatment. The reason for this is the worst case scenario was because occupational health & safety was unknown by the employees yet and the implementation of their daily work is far from risk control.

Table 1. Possible Level (AS / NZS 4360: Risk Management, 2004)

level	descriptor	commentary
1	Very Unlikely	Allows Never Happen
2	Unlikely	Can Happen, But rarely
3	possible	Can Occur in Certain conditions

level	descriptor	commentary
4	Likely	Can occur regularly
5	Almost Certain	Can happen anytime

Table 2. Severity and Impact (AS / NZS 4360: Risk Management, 2004)

level	descriptor	commentary
1	not significant	No injury, minor financial loss
2	Minor	Injury Mild, moderate Financial Losses
3	moderate	Moderate injury, need medical attention, a big financial loss
4	Major	Severe injury more than one person, a big loss, disruption of production
5	Disaster / extreme	Fatal more than one person, the loss is very large and widespread impact affecting long, a cessation of all activities

Table 3. Risk Matrix (AS / NZS 4360: Risk Management 2004)

Probability	*Consequences*				
	1	2	3	4	5
	(Insignifant)	*(Minor)*	*(Moderate)*	*(Major)*	*(Catastrophic)*
1 *(Very Unlikely)*	*LOW*	*LOW*	*LOW*	*MEDIUM*	*MEDIUM*
2 *(Unlikely)*	*LOW*	*MEDIUM*	*MEDIUM*	*MEDIUM*	*HIGH*
3 *(Possible)*	*LOW*	*MEDIUM*	*MEDIUM*	*HIGH*	*HIGH*
4 *(Likely)*	*MEDIUM*	*MEDIUM*	*HIGH*	*HIGH*	*VERY HIGH*
5 *(Almost Certain)*	*MEDIUM*	*HIGH*	*HIGH*	*VERY HIGH*	*VERY HIGH*

Information :

Medium Low = 1-3 = 4-9 Very High High = 10-16 = 20-25

3. RESULTS

In analyzing the variables risk, the authors identify all of the work processes and activities that result of risk, sources of risk and its effect. The approach taken to identify risk factors and the variables in this study is to conduct a field review, direct observation and interviews to some of the responsibility area.

Analysis of risk assessment based on primary and secondary data. Sources data comes from interviews, questionnaires and direct observations in the field regarding the risks which may occur at the work location. After data collection has been completed, Data and Information was processed through the processing stages is formulated as a function of possibility (likelihood) and the negative impact (impact) [4] or formulated as follows:

Risk Index = Probability (likelihood) × Impact (Impact).

Table 3. Risk variable

No.	**Event Risk (Risk Event)** **Activity (work activiy)**	**variable**
Occupation :Workshop		
1	preparation compressor	Lifting heavy objects manually Workers hit by forklift Forklift hit the car transporter Hand injury during the process of displacement
2	Lifting part with the chain block	Worker crushed by part Part fallen and corrupted due to any binding Chain block collapse
3	drain oil	Used oil spill fires Workers slip / fall due to oil spills
4	Hot work (welding, grinding, cutting)	Sparks exposure Respiratory problems due to welding fumes Fire due to gas leak Eye exposure to gram
5	Washing with cleaning chemicals	Leather Workers exposed to chemicals Chemical exposure to the eye
6	Repair parts	Workers sharp object punctured worker exposed by hammer Workers exposed to heat exposure
Occupation :Warehouse		
7	compressor movement (0.5-1.5 tons) By using a forklift	hand pinched Workers hit by forklift Forklift struck another vehicle

No.	**Event Risk (Risk Event)** **Activity (work activiy)**	**variable**
8	Use of Overhead cranes	Worker crushed by objects while lifting Property damaged crushed Worker fall from height during the lifting
Occupation: Fitting / Installation Compressor in factory		
8	Compressor lowering of the truck to the forklift	Forklift worker rammed
9	Electrical connection / power	Forklift struck other property Electrical shock Sparks cause fire
10	Work at height	Worker falls from a height Equipment falling under the exposed workers
11	Penyambunga pipe	Worker falls from a height Workers exposed pipes Injured while working with pipes
12	Scaffolding disassembly	scaffolding collapses Worker falls from a height Tube / frame fell and hit workers

Table 4. Analysis / Risk Level calculation

No.	**Risk (risk event)**		**Possibility**	**Impact**	**risk**
	activity	**variable**	**(P)**	**(D)**	**R = P x D**
1.	compressor preparation	Lifting heavy objects manually	4	4	16
2		Workers stroked by forklift	3	3	9
3		Forklift hit the car transporter	2	3	6
4		hand injury during the process of displacement	2	3	6
5	Lifting part with the chain block	Worker crushed by part	3	3	9
6		Part fall and corrupted due to any binding	2	2	4

No.	Risk (risk event)		Possibility	Impact	risk
	activity	variable	(P)	(D)	R = P x D
7		Chain block collapse	4	3	12
8	drain oil	Used oil spill	4	2	8
9		Fire from flammable materials in large quantities	4	5	20
10		Workers slip / fall due to oil spills	4	2	8
11	Hot work (welding, grinding, cutting)	Workers exposed to sparks,	3	3	9
12		Respiratory problems due to welding fumes	3	3	9
13		Fire due to gas leak	3	3	9
14		Eye exposure to gram	3	3	9
15	Washing with cleaning chemicals	Leather Workers exposed to chemicals	4	2	8
16		Chemical exposure to the eye	4	2	8
17	Compressor repair parts	Workers sharp object punctured	4	3	12
18		Worker crushed by a sledgehammer	4	3	12
19		Workers exposed to heat exposure	3	3	9
20	Displacement compressor (0.5-1.5 tons)	hand pinched	4	3	12

No.	Risk (risk event)		Possibility	Impact	risk
	activity	variable	(P)	(D)	R = P x D
21	By using a forklift	Workers hit by forklift	3	3	9
22		Forklift struck another vehicle	3	3	9
23	Use of Overhead cranes	Worker crushed by objects while lifting	3	4	12
24		Property damaged crushed	3	3	9
25		Worker fell when lifting process	3	4	12
26					
27	Compressor lowering of the truck to the forklift	Forklift worker rammed	3	3	9
28		Forklift hit other property	3	3	9
29	Electrical connection / power	Stung workers litrik	3	3	9
30		Sparks cause fire	3	3	9
31	Working at height	Worker falls from a height	3	4	12
32		Equipment falling under the exposed workers	3	4	12
33	Pipe connection	Worker falls from a height	3	4	12
34		Workers exposed pipes	3	3	9
35		Injured while working with pipes	3	3	9

No.	Risk (risk event)		Possibility	Impact	risk
	activity	variable	(P)	(D)	R = P x D
36	Scaffolding assembling	scaffolding collapses	2	5	10
37		Worker falls from a height	3	4	12
38		Tube / frame fell and hit workers	3	3	9

From the calculation of rik level, it can be obtained with a variable level of high risk (high risk) on some work or activity, namely:

a. Lifting heavy objects manually
b. Chain block collapse
c. Workers punctured sharps object
d. Hand exposed to hammer
e. Hand pinched
f. Worker crushed by objects while lifting
g. Worker fell when lifting process
h. Worker falls from a height
i. Equipment fell from a height on employees
j. Fires due to flammable material

One factor that makes the analysis results into extreme or high is a factor of knowledge workers are still low or minimum . Interviews with workers method was used to determine the risk of hazard control that has been done except from exist design and technical factors. The result of worker interview, general it can be concluded that the knowledge workers in occupational health and safety is still largely limited to personal protective equipment and hazard control strategies have not done a systematic risk and optimal.

4. DISCUSSION

Selection of the object study in this research is intentionally design for industry who do not know or are still minimal in occupational safety and health aspects, in this study selected industrial compressor installation. This is in addition to add literary as well as to introduce Occupational safety and health in the study work site. In the other side, it has previously been some work accidents is quite significant impact on workers.

Of the 10 variables were categorized as high risk, ie

a. Lifting heavy objects manually
b. Chain block collapse
c. Workers punctured sharps object
d. Hand exposed to hammer
e. Hand pinched
f. Worker crushed by objects while lifting
g. Worker fell when lifting process
h. Worker falls from a height
i. Equipment fell from a height on employees
j. Fires due to flammable material

Author categorize again 10 high variable to

a. Manual handling process
b. Lifting
c. Working at height and crockery
d. Fire

This is to facilitate the determination of the risk evaluation and their control.

The next stage after analysts proccess is the evaluation of risk, whether it is acceptable or not by the organization. The approach in determining the priority of the risks of using the Australian standard 10014b in which there are three categories of risk (4), namely:

- It is generally accepted (Generally acceptable)
- Egregious (Tolerable)
- Not acceptable (Generally unacceptable)

The discussion must be made directly by representatives of the heads of departments and the helm of the company through the coordination meeting. From all of the variables

that to be central issue concluded that the evaluation of the high risk is not able to accept (Generally Unacceptable). Since it is not acceptable, the Organization should undertake hazard and risk control measures.

Risk management is an important step and the most decisive in the overall risk management. Organizations must decrease the level of high risk (red) to medium risk (yellow) or low risk (green) to determine control measures are optimal and effective. Standard AS / NZS 4360 set the stage or in the selection of risk control, namely:

- Reduce likelihood
- Reduce the severity or consequence
- Divert partially or completely
- Avoid

This preliminary study already had decided level of risk. But for selected types of risk control has not been carried out by the Organization until the study was conducted one month ago. On the other hand, commitment to follow the determination of control has been agreed by top management and heads of department representatives' organizations so that further research can be conducted by the researchers. Form of risk control will be discussed in future studies which will also evaluation effectives control of hazards and risks can be lower / reduce accidents in the workplace.

5. CONCLUCIONS

The conclusion of this study is that the general picture of the hazards and risks have been reached through this preliminary study. Overview hazard and risks of high levels consist of Process Manual handling, Lifting, Work at heights and its equipment and Fire. from all the risk highest level there is the potential for fire from flammable material that has not been managed well with the risk index value 20. The next is also a central issue is the lifting heavy equipment manually with the risk index average of 16, followed working at heights as well as the equipment which is still minimal with the risk index average of 12 and the last lifting work also with the risk index 12.

The study of the knowledge and skills of workers to occupational safety and health found that the level of knowledge and understanding is very minimal or low almost all workers. Lack of training and education safety and health problem faced by the workers in the organization. The results of this study have also been followed up by top management and department heads of the organization after the delivery through the coordination meeting for the organization that strengthens the continuation of this research in the future.

Acknowledgment

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Ethical approval

Not applicable for this study.

Competing interst

The author hereby declares that this research there is no conflict with a particular interest in addition to the research objectives.

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Metal Copper Smelters Chemical Health Risk Assessment "Systematical Review"

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Abstract

Project Workers with daily activity in metal smelter and refinery area which air contain chemical dust (Ar, SO4, H2SO4, CaCO3) are object to be observe. Process activities have some serious chemical potential to health problems. This paper conducted to identify factors related to work environment condition by to chemical health risk to project workers. The method is a systematic review will search for publication in the following search engine and database as online searching JStor, ProQuest, Science Direct, Springer Link and Local Journals by year of publication from 2000 to 2017. Journals were screened by title and abstract according to the research topic then filtered using criteria inclusion was only research in English language and describe health risk assessment in copper smelter area. According to the result of the journals review shown that, copper production has major influence on air pollution. Exposure chemical dust or particulates represented a threat to human health. Another result showed that cancer risk due to inhalation exposure and dermal contacts. Cu in small number is important in diet to keep people healthy. However, a single intake or a very high intake per day can be dangerous. When drink water with Cu levels higher than normal will result in vomiting, diarrhea, stomach cramps and nausea. If the arsenic intake is very high it can cause liver and kidney damage, even death. Inorganic arsenic has been known as a human toxin for a long time, which can lead to death. Low doses will result in tissue damage. When through the mouth, in general, the effects are irritation of food channels, pain, nausea, vomiting and diarrhea. It also results in decreased formation of red and white blood cells, impaired heart function, damage to blood vessels, injuries to the liver and kidneys. Exposure SO4, H2SO4 through ingestion has severe effects, burning in the mouth, pharynx, abdomen followed by vomiting, diarrhea, dark red stools

(melena). Blood pressure dropped dramatically. Exposure through inhalation causes respiratory tract irritation, coughing, choking, then pulmonary edema, narrow chest, low blood pressure and rapid pulse. Exposure through the skin is very painful and skin burns. CaCO3 dust cause the incidence of acute respiratory tract infected to workers.
Keyword: Copper Smelter, Chemical Health Risk Assessment, Human, Impact**.**

1. INTRODUCTION

Worker health aspect

Workers who work in dusty enviromental industri daily exposed with chemical substaant, diferent type of health hazards such as Ar, SO4, H2SO4, CaCO3, which has risk factor to developing occupational desease. Copper Smelting is one of industry that involved to development industry in advance and modern world.

Copper Smelting dust could cause lung function impairment, chronic breath problem. Other studies presented that, pneumoconiusis and carcinoma to lungs. Others shown that teh dust have effect to blood system circulation, and could reach the essentially such as bone, heart, liver etc. Effect feels more hard when dust inhale by childrenwho live near the copper smelter plant.

Chemical Dust by Process

Pyrometallurgically or hydrometalurgically can produces copper. The traditional process is based on roasting, smelting on reverbatory furnaces (or electric furnaces), produce matte (copper-iron sulfide), and converting for produce of blister copper, which is further refined to cathode copper. This route for production of cathode copper requires large amounts of energy per ton of copper: 30–40 million British thermal units (Btu) per ton cathode copper. It also produces furnace gases with low sulfur dioxide (SO) concentrations from which the production of ulfuric acid or other products is less efficient [1]. The SO^2 concentration on exhaust gas from a reverbatory furnace is about 0.5–1.5%; that from an electric furnace is 2 about 2–4%. So-called flash smelting techniques have therefore been developed that utilize the energy released during oxidation of the sulfur in the ore. The flash techniques reduce the energy demand to about 20 million Btu/ton of produced cathode copper. The SO concentration in the off gases from flash furnaces is also higher, over 30%, and is less expensive to convert to sulfuric acid. Flash processes since the 1950s [2].

2. METHODS

The Systematical review of Chemical Health Risk Assessment related to copper smelting was conduct in September 2017. The following electronic database were searched: Jstor, ScienceDirect, Proquest, SpringerLink, Google Scholar and Local Journal (2000 – 2017). This research stategy included all type of studies, but only in English. Reference from local articles were also searched by hand screening to identify the relevant articles. Keywords was used as search provisions: “Copper Smelter “AND “Chemical Health Risk Assessment “AND “Human “AND “Impact”.

Review Procedures

From previous systematic of Chemical Health Risk Assessment Copper Smelter, studies have been found to be heterogeneous, as they were conducted in different countries, different methods, different unit of observations, for this reason we did not try to analyse the data from those points of view, but we review the results summarized to find out the best way to identify that phenomenon, and find the CHRA related to Copper Smelter.

Inclusions/ Exclusions Criteria

Writers classified all types of studies that reported the Health Risk Assessment. Writers not classified letters, conference papers, opinions, and reports from media and editorial papers. A good quality assessment to identified studies was performed. Writers evaluated the papers based on the following criteria: Purpose of this paper is to give clear description about CHRA and Copper Smelter.

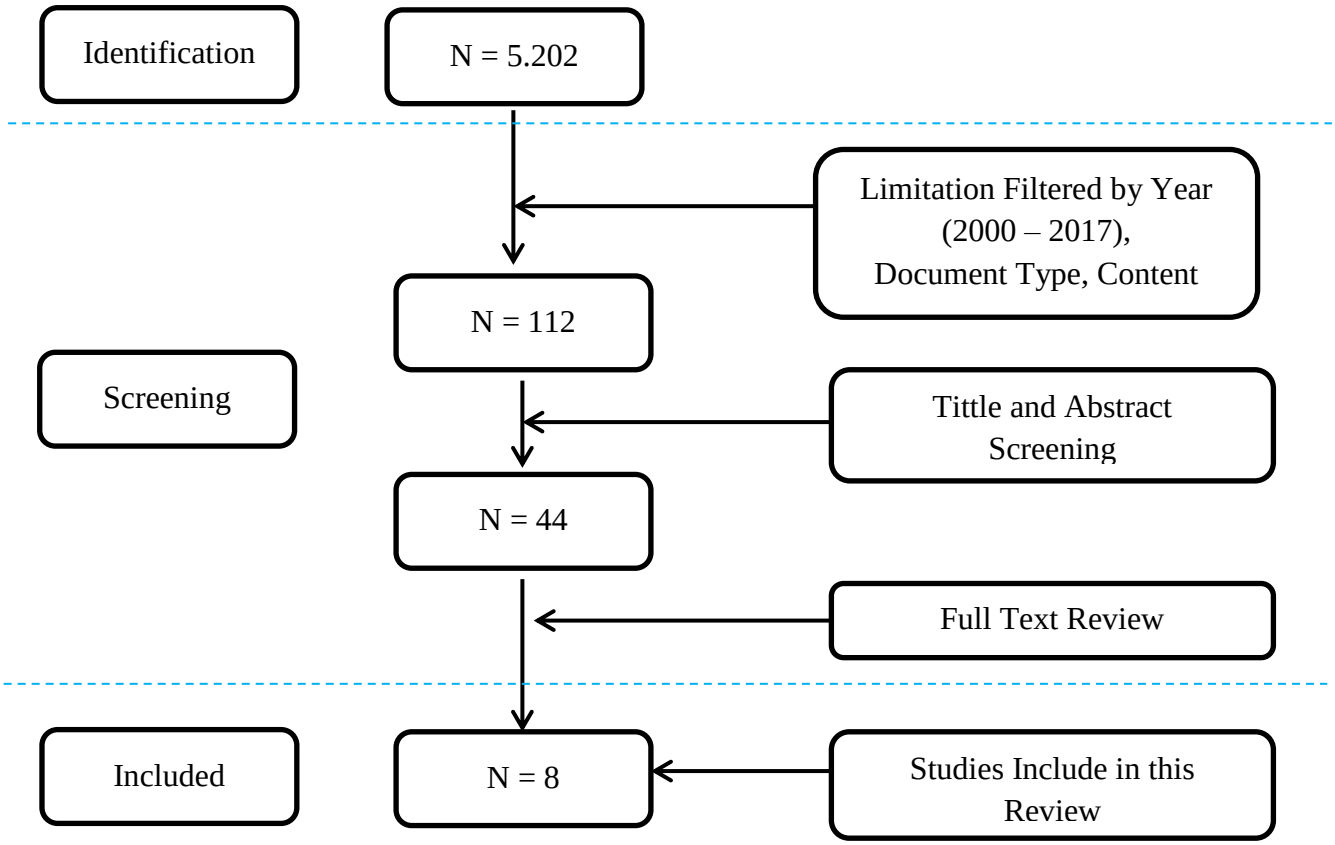
3. RESULTS

Writers found 5.202 articles search by using database online : Jstor, Google Scholar, ProQuest, ScienceDirect, Springer and local journal. “Google Scholar search engine, result 580 articles, filtered by year, English, discipline, content type, document type and remove the duplicate, resulting 22 articles. Tittle and abstract screening resulting 5 articles being full text review and 2 articles were selected. Proquest serach engine resulted 4.103 articles, filtered by year, english, discipline, content type, document type and remove for duplicating resulting 14 articles. Tittle and abstract screening resulting 1 article. Science Direct search engine resulted 430 articles. Filtered by year, english discipline, content type, document

type and removal duplicating resulted 2 articles. Springer search engine resulted 69 articles. Filtered by year, english, discipline, content type, document type and removal duplicating resulting 6 articles.

At the final, writers included 8 articles studies in this systematic review (Fig. 1). Articles that choosed and assessed for review were article tha relevant to research. Eventhought, articles that unchoosed for this research were article did not relevant with question and did not relevant with teh research.

Figure 1. Systematic Review Flowchart



No	Tittle	Authors/ Year	Time Research	Object to be Observe	Unit of Observe	Study Design	Result
1.	Reassessing the Link between Airborne Arsenic Exposure among Anaconda Copper Smelter Workers and Multiple Causes of Death Using the Parametric g-Formula	Alexander P. Keil and david B. Richardson	1938 – 1956, 1990	Estimate the excess of mortality from respiratory cancer, heart disease, others caused by occupational arsenic exposure	8.014 male workers on anaconda Cu-Smelter	Cohort	The paper suggest that the excess deaths from cause other than respiratory cancers comprises the majority of the excess deaths caused by inhaled arsenic exposure. Healthy workers survivor bias may have masked such association in previous analyses. These result emphasized the need for consideration of all exposure routes for upcoming risk assessment by the U.S. Environmental Protection Agency. Estimate that eliminating arsenic exposure would prevented 22 death case by age 70 22 per 1000 workers. Of those 22 excess death, estimation 7.2% would be death due to heart disease, 4.0% due to respiratory cancer, 11% due to others case. [3]
2	Exceedance of air quality standart resulting from pyro–mettalurgy production of copper: a case study, Bor (Eastern Serbia)	Snezana M. Serbula. Tanja S. Kalinovic. Jelena V. Kalinovic. Ana A. Ilic	1994–2008	To Present air pollution caused by SO2 and As in the urban – industrial zone	Brezonik, Town Park, Urban Institute, Jugopetrol	Cross Sectional	The prediction equation of daily SO2 concentration represent a good model with regression coefficient from 0.854 to 0.926 at all measurement site. Correlation analysis showed that eastern and western wind increase SO2 concentration, thus increasing health risk of the inhabitants in the study area. [4]
3	Arsenic exposure and its Impact on health in Chile	Catterina Ferrecio adn Ana Maria Sancha	1994 – 1998	An estimate of daily ambient exposure by combinin ginformation obtain through envronmental monioring	Arsenic-study exposure of entire Chilean populatio n	Cohort	Characteristic of arsenic risk are very similar in different ethnic and cultural group. Excess of lung cancer in general population was caused by arsenic interact in drinking water, smoking to increase risk of lung cancer, arsenic interact with nutritional to increase health effect, skin lesions present of dose – response interact with arsenic. [5]
4	Health risk assessment of heavy metal exposure to street dust in the	Na Zheng a, Jingshuang Liu a,		Determaine the spatial distribution of chemical	Industrial area of Huludao	Epidemiolo gical Cross Sectional	The biggest contribution to street dust is atmospheric deposition due to metal smelting, but traffic density makes slight contribution to heavy metal contamination. According to the calculation on Hazard Index (HI), in the case of noncancer effect,

No	Tittle	Authors/ Year	Time Research	Object to be Observe	Unit of Observe	Study Design	Result
	zinc smelting district, Northeast of China	Qichao Wang a, Zhongzhu Liang b		dust and to estimate population health risk due to heavy metal dust exposure and cancer risk			the ingestion of dust particles of children and adults in Huludao city appears to be the route of exposure to street dust that results in a higher risk for heavy metals, followed by dermal contact. The inhalation of resuspended particles through the mouth and nose is almost negligible. The inhalation of Hg vapour as the fourth exposure pathway to street dust is accounting for the main exposure. Children are experiencing the potential health risk due to HI for Pb larger than safe level (1) and Cd close to 1. Besides, cancer risk of Cd due to inhalation exposure is low. [6]
5	Health implications of the distribution of arsenic species in airborne particulate matter	D. Sanchez-Rodas a, b,∗, A. Sanchez de la Campa b, V. Oliveira b, J. de la Rosa b	2001 – 2008	Airborne Particuate Matter (PM) of Huelve ambienet air	Huelva, southwestern Spain	Cross sectional	The results obtained by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) showed that arsenic accumulates preferentially (ca. 70–80%) in the par- ticles with smaller diameter (PM2.5 versus PM10), representing a threat to human health due to the higher capacity of the finer particles to enter the organism through the respiratory system. Moreover, the toxicity of the inorganic arsenic species depends also on the oxidation state, As(III) being more toxic that As(V). The speciation analysis performed with High Performance Liquid Chromatography-Hydride Generation- Atomic Fluorescence Spectrometry (HPLC-HG-AFS) with samples collected between 2006 and 2008, showed that As(V) represented the main arsenic species, but As(III) was also found at significant concentration, represent- ing a 5–10% of the total arsenic content. The results also indicate that the more toxic As(III) tends to concen- trate preferentially in the finer fraction PM2.5 in comparison with As(V), thus representing an added health risk for the local population. [7]
6	Releases from copper smelters and refineries and zinc plants in	R.Newhook, H.Hirtle, K.Byrne, M.E.Meek	1998	6 copper smelter, 4 refinery copper, 4 zinc	Health risk evaluating on emissions	Cohort	In these assessments of releases from copper smelters and refineries and from zinc plants as Priority Substances under the Canadian Environmental Protection Act (CEPA), available data were critically evaluated to determine if environmental exposure

No	Tittle	Authors/ Year	Time Research	Object to be Observe	Unit of Observe	Study Design	Result
	Canada: human health exposure and risk characterization			plants.			to selected components of these releases poses a risk to human health.The data on airborne levels of a variety of toxic substances near these facilities in Canada were obtained from the companies or provinces and systematically analyzed. Monitoring of ambient air near the Canadian copper smelters and refineries and zinc plants indicates that releases from these facilities result in increased potential for inhalation exposure of local human populations to several components of releases (As, Cd, Cr, Ni, Pb, SO_2 and PM10). Airborne levels in the vicinity of these metal-processing operations overlap those associated with cardiorespiratory effects for PM10 , and exceed health- based guidelines for SO_2 and, near some facilities, Pb.In addition, the margin between levels of As, Cd, Cr and Ni near these facilities in Canada and carcinogenic potency for each of these metals is relatively small near copper smelters, larger near copper refineries, and intermediate near zinc plants.On this basis, the risk to human health from environmental exposure to releases from these facilities is considered to be high compared with other Priority Substances assessed under CEPA, especially for facilities where copper is smelted. [8]
7	Size distribution and chemical composition of particulate matter stack emissions in and around a copper smelter	Yolanda Gonza lez-Castanedo a, *, Teresa Moreno b, Rocío Fernandez-Camacho a, Ana María Sa nchez de la Campa a, Andre s Alastuey b, Xavier	29 August – 7 September 2011	Industrial Air Polution	As, Cd, Cu, Zn, Pb, Bi	Cross Sectional	The results demonstrate that the Cu-smelter is an important source of inhalable toxic elements carried by fine airborne particles. The pollution abatement systems applied so far appear to be relatively ineffective in preventing metalliferous air pollution events, potentially increasing health risks to local and regional populations. [9]

No	Tittle	Authors/ Year	Time Research	Object to be Observe	Unit of Observe	Study Design	Result
		Querol b, Jesús de la Rosa a					
8	Assessment of air pollution originating from copper smelter in Bor (Serbia)	Snezana M. Serbula • Ana A. Ilic • Jelena V. Kalinovic • Tanja S. Kalinovic • Nevenka B. Petrovic	2005 – 2007	Determine the impact of Cu – Smelter emission on the air. In order to meet air quality standart.	Urban and suburban area of Bor Town, Serbia	Cross sectional	The results of principal component analysis showed that copper production has major influence on air pollution. In other hand, the High SO loads were also observed at all the measuring sites, due to pyrometallurgical processing of sulphide copper ores. Frequent daily and annual exceeding of the LVs enlarge health risk, since the epidemiological studies have shown that inhalation exposure to SO leads to respiratory diseases, such as asthma. The results of the cluster analysis confirmed the high loads of As and SO in the air by grouping these pollutants into separate clusters. The correlation analysis showed that As and studied metals have the same emission source. The results of the PCA showed that copper production has major influence on air pollution, especially on ambient SO2 [10]

Characteristic of Included Studies

4 of 8 studies were cohort studies, 4 of 8 studies were cross sectional studies these studies condusted in South America, Serbia, Spain, Canada, Chile, China. There were several unit of observation: internal industry area and population. Effect of exposeure of arsenic, SO2 and chemical dust exposure and cancer risk.

Types of Exposure Effect

All Assessed studies chemical health risk assessment, 4 of 8 strudied assessed type of exposure effect: respiratory disease (Lung Cancer, Bronchictasis, Bronchitis) Vascular diseseas (premature cardiac, bladder cancer), dermal disease (lesions, redness, bumps with water inside, burning skin). 1 of 8 studies assessed, an important source of inhale toxic element carried by airborne. 1 of 8 studies assessed, the biggest factor of total element is Arsenic particulate, and also bring the biggest factor thus representing chemical health risk particularly in population area. 1 of 8 studies assessed, element (Particualte Matter) thus release to airborne in potential increase for inhalation factor of disease of local population. 1 of 8 studies assessed, estimate that by eliminating arsenic exposure, could prevent the death by age 70 about 22 of 1000 workers.

4. DISCUSSIONS

The aimed of this systematic review was to review chemical hazard and health risk assessment relating to copper smelter industry and popuation area. Heatlh Risk Assessment are important factor who work and life around the smelter. Journals has done to review in systematic review way has review in area of studies in case to find out CHRA and copper smelter effect to health extensively. There was all studies said that all chemical dust result of smelter process has negative effect to health not only to workers, but also to society who life around the smelter factory. Heavy metal has carcinogent and noncarcinogent effects, carcinogenic and non carcinogenic expose through food and soil ingetion adn dermal contact In these countries–industrial, residents are exposed to mainly via consumption of food stuffs, rather than ingestion of or contact with soil. 9, there have been reports of arsenicosis—leukoderma, melanoderma, and hyperkeratosis— but only related with workers; couple years after the increase of arsenic exposure in drinking water, arsenicosis associated with respiratory symptoms, including diffuse and segmentary bronchiectasis.

Years after peak exposure, 28% showed chronic bronchitis compared until only 4% among children of the non-exposed, the prevalence of cough or dyspnea dropped from 38% to 7%. In the general population, there was an excess of respiratory symptoms and vascular problems associated with arsenicosis.

A few years after peak exposure, reported showed to peripheral vascular diseases, including Raynaud syndrome and ischaemia of the tongue. 22% percent presented peripheral vascular syndromes, such as chrocianosis, and 30% had Raynaud syndrome compared to none among Iquique patients. In 1973, researchers deduced that the most frequent clinical complications in children associated with arsenic in drinking-water were respiratory and cardiovascular diseases 53% of these younger cases presented arsenicosis. Peculiar vascular lesions, composting of thickening of small and medium arteries, were found, mainly in the heart, gastrointestinal tract, skin, liver, and pancreas. Studied comparison, the morbid condition associated with ingestion of arsenic had resulted in: system arterial disease, spread hypertrophy of the myocardium, arterial hypertension, arterial thrombosis, bronchiectasis, hepatic cirrhosis, hemangioendothelioma of the liver, chronic diarrhea, time after time bronchopneumonia, and bilateral pneumonia.

Limitation

Limitations of this paper shall be considered in interpreting the conclusion and result. The writers access the electronic database for completing this paper only Jstor, ScienceDirect, Proquest, SpringerLink, Google Scholar and Local Journal, thus online database that used due to can be access for free. Writers might miss some articles from another online database. The strategy designed to as effective as acceptable. Writers only use English article, it could generates some biases for articles with no English, another method, design study, place, point of view and result. Writers did not count the data from articles reviewed, writers only summarized the articles to find another conclusion if possible.

5. CONCLUSION

The chemical health risk assessment to workers copper smelters in the smelter plant is affected significantly. Reports and investigations on estimate and assessment the toxicity values and exposure are scanty. In estimate and aseessment chemical health risk assessment, these are a need furthure research of dust xposure and transport related to

wind and speed direction and epidemiological study, including human and environmental. But, generally has the same result to negative effect. Measly collect positive effect related to it.

ACKNOWLEDGEMENT

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Evidence of Noise-Induced Hearing Loss Among the Workers at Production Site of Water Supply Company PT. XYZ

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Abstract

PT. XYZ is a water supply company, in its business process PT. XYZ has 23 departments which have various work patterns, locations, and noise sources. The aims of this study are to find the evidence of noise-induced hearing loss among the workers at PT. XYZ and describe the distribution of prevalence of workers who had NIHL. A total of 483 workers were analyzed by univariate method. The result showed that the prevalence of NIHL among workers at PT. XYZ are 42 (8.7%) on right ear and 51 (10.6%) on left ear. Obtained a result of 97.6% and 96.1% of workers who had NIHL are male. On the other hand, 97.6% and 90.2% of workers who had NIHL are above 40 years old. Further research is needed to prove the cause of NIHL among workers at PT. XYZ.

Keywords: Noise-induced hearing loss, water supply company, audiometry

1. INTRODUCTION

PT. XYZ is a water supply company which serving 3 million people in Jakarta Capital City with 9000 litre per second supply. PT. XYZ sells 162 million m^3 water in 2016 and will be targeted to be 170 million m^3 water in 2017 [1]. To serving its customers, PT. XYZ operates all of its business activity in 24 hours a day, 7 days a week, during day and night. PT. XYZ also has 23 types of job (departments) which have various work location and occupational hazard. PT. XYZ has 6 water treatment plants, 37 booster pumps, 1 head office, 3 main area offices, and many customer offices, those are located spread throughout Jakarta.

With the number of work locations and types of job, the chances of workers to be

exposed to the noise hazard are enormous. For example: in Production department, PT. XYZ using many machines and pumps that produce noise. In Distribution Construction department, the workers using many construction equipments that produce noise. It can cause the workers exposed by noise hazard. The excalation of target and workload could make noise hazard exposure increase. Noise hazard that exposes the workers could make noise-induced hearing loss (NIHL) among the workers.

Noise-induced hearing loss (NIHL) is the second most common acquired hearing loss following presbycusis, and is known as an occupational disorder long ago [2]. In spite of implementation of hearing conservation programs, NIHL is among the most important and frequent occupational disorders and the second cause of occupational injuries. NIHL is permanent and irreversible, but it can be preventable [3]. The NIHL can be caused by occupational hazard in the workplace and/or personal characteristic such as age and lifestyle [4].

Nowadays in Indonesia, there are only a few research about noise-induced hearing loss (NIHL) in water supply company. It needs more research to analyse the description of NIHL many kind of industries in Indonesia. The aims of this study are to find the evidence of noise-induced hearing loss among the workers at PT. XYZ and describe the distribution of prevalence of workers with NIHL.

2. METHODS

This study applies cross-sectional design using secondary data. The secondary data was obtained from Environmental Health & Safety Division of PT. XYZ in 2014. In this study, will be assessed the result of audiometry measurement from yearly workers medical check-up at PT. XYZ to find the evidence of NIHL among the workers and describe how the distribution. PT. XYZ has 1156 total workers, however only 483 workers were measured in audiometry due to their type of job and work location. The average of Hearing Threshold Limit (HTL) is calculated at a frequency of 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz according to Permenakertrans 25/2008 [5]. Then an univariate analysis was conducted to determine if there were workers suffer NIHL and to determine the distribution of employe with NIHL based on type of job, age and gender.

3. RESULTS & DISCUSSIONS

The average of Hearing Threshold Limit calculation result showed that there were 42 workers who suffer NIHL on the right ear and 51 workers who suffer NIHL on the left ear from the total 483 workers who have measured their hearing function by audiometry. In the percentage is shown at Figure 1 and Figure 2.

Figure 1. Prevalence of NIHL on Right Ear

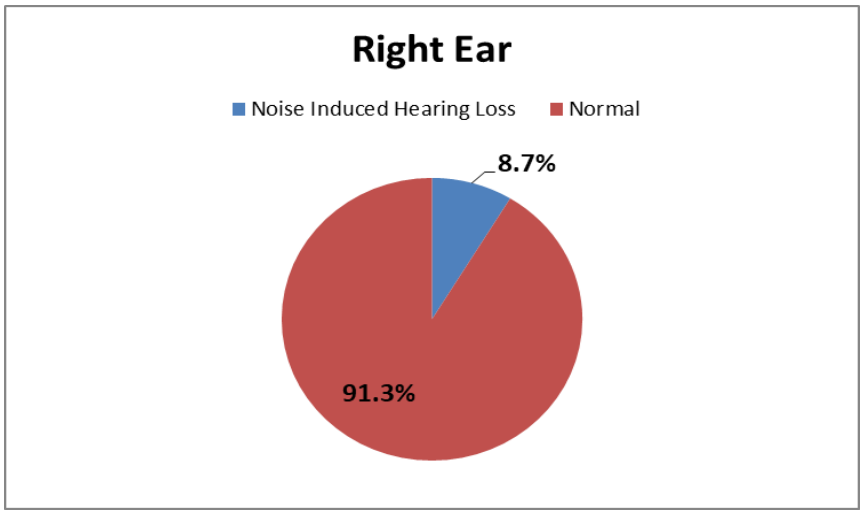
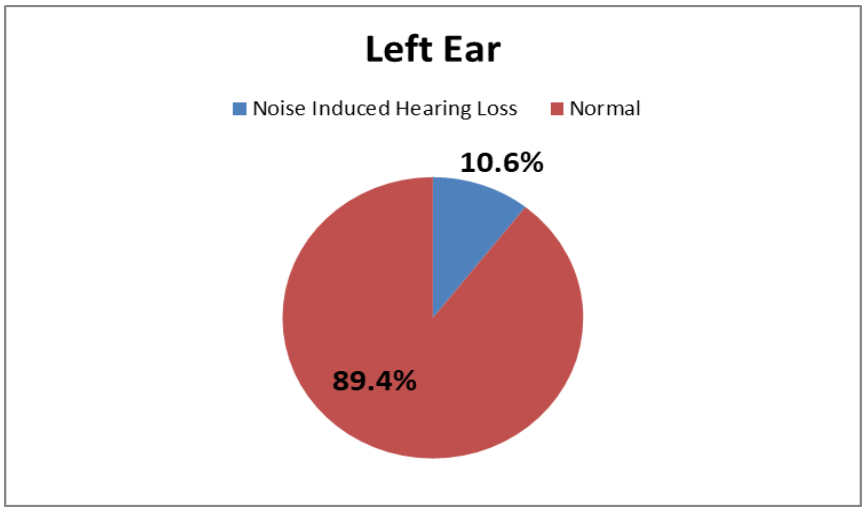


Figure 2. Prevalence of NIHL on Left Ear



The results show evidence that there are workers at PT. XYZ suffering from NIHL. Prevalence of NIHL at PT. XYZ is smaller than the steel smelting industry, plywood and air force helicopter crew. In NIHL steel smelting industry 31.55%, industry plywood

31.81% and air force helicopter crew prevalence of 27.16% [6]. Despite the prevalence at PT. XYZ is smaller than the three types of industry, NIHL among workers of PT. XYZ can not be ignored. There is a need for preventive program such as Hearing Conservation Program, so that NIHL prevalence does not increase.

If analyzed by variable of the type of work and work location, it can be concluded that 3 types of jobs that have workers with the highest NIHL are Production 2, Production 1 and Distribution Network Center Area with the percentages respectively 17.6%, 14.3% and 14.3%. It should be further investigated why these three types of work have the highest NIHL prevalence. In detail of distribution prevalence of NIHL at PT. XYZ by type of work can be seen in Table 1.

Table 1. Distribution of Prevalence NIHL Based On Type of Job

Type of Job	Frequency		Percentage	
	Right Ear	Left Ear	Right Ear	Left Ear
Customer Investigation	3	2	7.1%	3.9%
Manager	1	0	2.4%	0.0%
Building & Office Management	1	1	2.4%	2.0%
CAPEX & Asset Management	1	1	2.4%	2.0%
Central Maintenance	1	3	2.4%	5.9%
Commercial Losses & Metering	1	1	2.4%	2.0%
Customer Care	1	3	2.4%	5.9%
Distribution Construction	1	1	2.4%	2.0%
Booster Pump	2	4	4.8%	7.8%
DN Unit UPP West	5	3	11.9%	5.9%
DN Unit UPP Center	6	6	14.3%	11.8%
DN Unit UPP South	3	0	7.1%	0.0%
Industrial Relation & Security Management	1	0	2.4%	0.0%
Leak Detection and Repair	3	4	7.1%	7.8%
Office Security Management	0	1	0.0%	2.0%
Permanent Area Study	2	1	4.8%	2.0%
Production 1	6	6	14.3%	11.8%
Production 2	4	9	9.5%	17.6%
Transmission Network	0	4	0.0%	7.8%
Water Resources Development & Process Optimization	0	1	0.0%	2.0%
Total	42	51		

According to the gender variable, the results showed that 97.6% of workers with NIHL on the right ear were male and 96.1% of the workers of NIHL patients in the left ear were male. The remaining 2.4% and 3.9% of workers of NIHL patients in the right and left ear are female. A comparison of the number of workers of NIHL patients in terms of gender variables can be seen in Table 2.

Table 2. Variable Gender at PT. XYZ

Gender	Frequency		Percentage	
	Right Ear	Left Ear	Right Ear	Left Ear
Male	41	49	97.6%	96.1%
Female	1	2	2.4%	3.9%
Total	42	51		

According to the age variable, the results showed that 97.6% of workers with NIHL on the right ear in PT. XYZ is above 40 years old and 90.2% of workers with NIHL on the left ear in PT. XYZ is over 40 years old. While 2.4% and 9.8% of workers of NIHL patients in the right and left ear are under and equal to 40 years. Complete data on the distribution of NIHL patients by age is presented in Table 3.

Table 3. Variable Age at PT. XYZ

Age	Frequency		Percentage	
	Right Ear	Left Ear	Right Ear	Left Ear
>= 40	41	46	97.6%	90.2%
<40	1	5	2.4%	9.8%
Total	42	51		

4. CONCLUSIONS

The conclusion of this research is found there is evidence that among employees of PT. XYZ there were 8.7% of employees suffering from NIHL on the right ear and 10.6% of employees suffering from NIHL on the left ear. Prevalence of NIHL among employees of PT. XYZ is still lower than the prevalence of NIHL in steel smelting, plywood and air force helicopter crews. Based on the type of work in PT. XYZ, the highest prevalence of work in Production Department 2 is 17.6%. By age, 97.6% of workers with NIHL on the

right ear in PT. XYZ is over 40 years old. By gender, 97.6% of workers with NIHL on the right ear in PT. XYZ are male.

5. RECOMMENDATION

To prove the cause of NIHL among employees of PT. XYZ, it needs further research. That study is to prove whether workers with NIHL at PT. XYZ is caused by hazard noise in the workplace or because of personal characteristics such as age and lifestyle.

Competing interest

I declare that I have no significant competing financial, professional or personal interest that might have influenced the performance or presentation of the work described in this manuscript.

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Eicosapentaenoic Acid (EPA) from Fish Oil and Margarine as Bioactive Compound for Anti-Inflammatory in Occupational Dermatitis

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Abstract

Occupational dermatitis (OCD) is a skin inflammatory disease caused by allergen and irritant agent at workplace. The disease related hypersensitivity reaction correlated with immunological mechanism (allergic contact dermatitis) and non-immonological mechanism (irritant contact dermatitis). Patient with atopic history (rhinitis allergic, asthma, and atopic dermatitis) has higher risk of OCD. In atopic individu has barrier skin damaged that increased the risk of allergen and irritant penetration. Inflammatory reaction involved T-helper 1 (Th1) which produced cytokine Tumor Necrosis Factor (TNF α), Interferon- γ (INF- γ), then T-helper (Th2) produced interleukin (IL-4, IL-6, IL-8, IL-10). Eicosapentaenoic Acid (EPA) is an omega 3 from Polyunsaturated Free Fatty Acids (PUFAs) has been shown as an anti-inflammatory effect, and decreased macrophage accumulation. In the inflammatory process, EPA inhibited IL-6, IL-8, and TNF α which are mediated by Free Fatty Acid Binding Proteins (FABPs). The aim of this study is to determine the bioactivity compound EPA for anti inflammatory agent and its target based on in silico screening. The bioinformatics tool based on reverse docking used in this study were Pubchem compound databese, protein target prediction data base, Pharmmapper and Swiss Target Prediction, molecular docking software PyRx 0,8, ligand docking and binding site

analysis with PyMOL software. Docking and binding site analysis showed that the EPA was able to interact with FABPs with binding affinity of EPA with FABP 4 highest (- 4.2 kcal /mol) than hydrocortisone with FABP 4 (-7.4 kcal /mol). EPA has same binding site and relative bonding power with the FABPs then it is potential to be an alternative medicine for anti-inflammatory in OCD.

Keywords*:* Occupational dermatitis, Eicosapentaenoic acid (EPA), Free Fatty Acid Binding Proteins (FABPs), reverse docking

1. INTRODUCTION

The National Institute of Occupational Safety and Health (NIOSH) included dermatologic disorders on the top 10 work-related disease and injures in United States. The most common injuries are due to lacerations, punctures, abrasions, and burns. Occupational contact dermatitis (OCD) is a skin inflammatory disease caused by allergen and irritant agent at workplace. The disease related hypersensitivity reaction correlated with immunological mechanism (allergic contact dermatitis) and non-immunological mechanism (irritant contact dermatitis) [1]. Contact dermatitis account for 90% of occupational skin disease. Among host-related factors, atopic dermatitis has been the most well investigated risk factor for developing occupationally induced skin diseases, particularly hand dermatitis in adult atopic. Individual atopic dermatitis have a reduced threshold for developing irritant contact dermatitis from soaps, detergents, solvents, and chemical irritant [1,2].

Patient with atopic history (rhinitis allergic, asthma, and atopic dermatitis) has higher risk of OCD. Atopic individu has barrier skin damaged that increased the risk of allergen and irritant penetration. Inflammatory reaction involved T-helper 1 (Th1) which produced Tumor Necrosis Factor (TNF α), Interferon- γ (INF- γ), then T-helper (Th2) produced interleukin (IL-4, IL-6, IL-8, IL-10). The worldwide prevalence of AD has increased during the past three decades, and it often begins during early childhood, and adult patients frequently have chronic diseases. The etiology of atopic dermatitis is unknown, but most individuals who are affecting have associated with allergic manifestations (e.g. asthma, food allergies, seasonal allergies), and there is no definitive treatment for AD [1,3].

Polyunsaturated free fatty acids (PUFAs) such as eicosapentaenoic acid (EPA) have a major impact on human health outcomes, such as motor and cognitive development, mental health and psychiatric disorders, cardiovascular disorders and immunologic and inflammatory responses [4]. EPA cannot be produced by humans, primarily found in dietary fish oils and derived also from plants in margarine [4,5]. EPA have been shown to have anti-inflammatory effects, and biological effects are mediated by the production of preresolving mediators, which have been proposed to modulate and likely resolve inflammatory responses [5,6]. This study aimed to discover natural bioactivity compounds of eicosapentaenoic acid (EPA) from fish oils and margarine for the treatment of occupational contact dermatitis based on in silico screening.

2. METHODS

Ligand Preparation

Chemical 3D structure and SMILES of EPA obtained from the PubChem compounds database (https://pubchem.ncbi.nlm.nih.gov/) with number ID: CID 446284.

Target Selection

Target protein for EPA obtained by entering SMILES to multiple servers which are swiss targets prediction (http://www.swisstargetprediction.ch/) and pharmmapper (http://59.78.96.61/pharmmapper/submit_file.php). The server will provide a list of predicted target protein for EPA. The list of target proteins from both servers are compared and selected protein targets with the most potential for ligand (EPA).

Molecular Docking

Molecular docking for EPA, target protein, and compound control performed using *PyRx*0.8 software

Molecular Visualization and Inter Molecular Interaction

Interaction between EPA, target protein and control compounds visualized and analyzed using PyMol and LigPlus, and Biovia Discovery Studio 2016 Client.

3. RESULTS

The results of target selection using pharmmapper (job ID: 17091218418) and swiss target prediction (SMILES: CCC=CCC=CCC=CCC=CCC=CCCCC(=O)O) obtained the potentially interact protein target with EPA is Fatty acid-binding proteins 4 (FABP 4). FABP 4 belongs to a family of cytosol proteins with small molecular weight (15 kDa) that bind with high affinity to unsaturated long-chain fatty acids. FABP 4 plays a role in active regulation of lipid trafficking and inflammatory activity and highly expressed in almost all tissues with high rates of fatty acid uptake and lipid metabolism [7,8]. Fatty acid shifted to the long-chain fatty acids (LCFA) which are transported by FABPs to various tissues, where they are metabolized, stored or utilized [8]. Fatty acids, such as EPA, can be metabolized into a diverse and large family of bio-active lipid mediators called eicosanoids, which may have function as anti-inflammatory mediators [9,10,11].

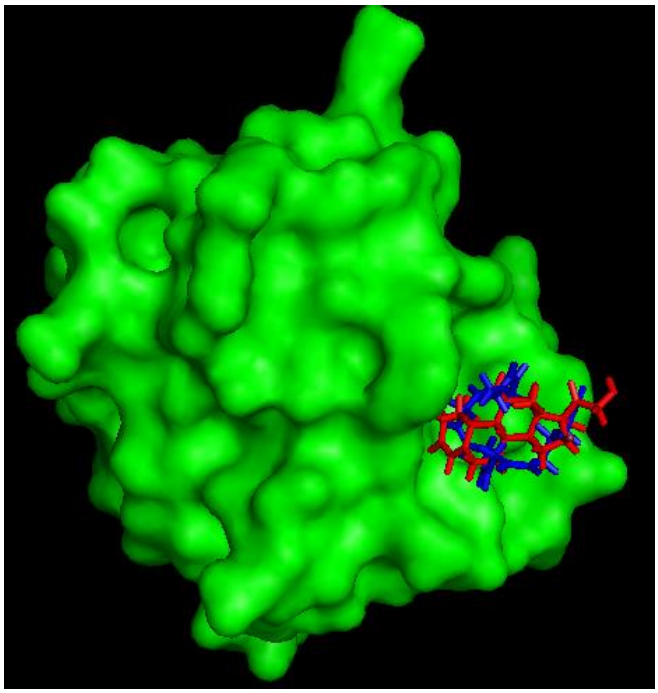

Figure 1. Results of molecular docking 3D structure between protein target (Fatty acid-binding proteins 4), candidate ligand (eicosapentaenoic acid), and control ligand (hydrocortisone), which indicates that the ligand capable to interact with protein target on the same binding site. Description: green (FABP 4), blue (EPA), red (hydrocortisone).

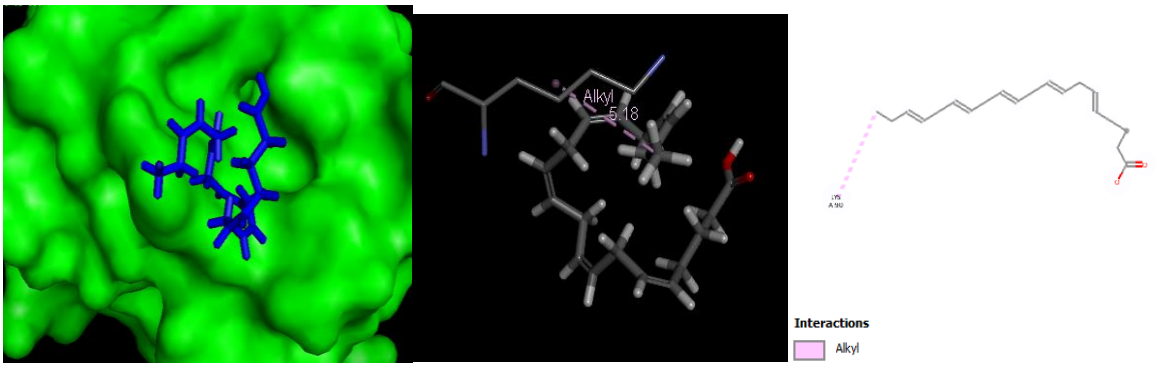

Figure 2. Visualization interaction between eicosapentaenoic acid (EPA) with Fatty acid-binding proteins 4 (FABP 4) using *Discovery Studio Client BIOVIA,2016.* (a) EPA (blue) binds to protein target (FABP 4) (b) The distance of type of interaction or bonding between EPA with FABP 4 (c) The types of interactions between the amino acids of EPA with FABP 4.

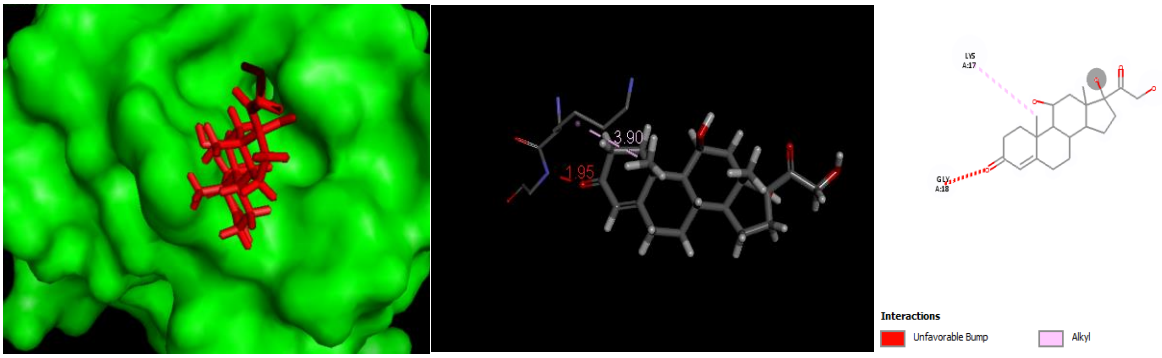

Figure 3. Visualization interaction between hydrocortison with Fatty acid-binding proteins 4 (FABP 4) using *Discovery Studio Client BIOVIA,2016.* (a) Hydrocortison (red) binds to

protein target (FABP 4) (b) The distance of type of interaction or bonding between Hydrocortison with FABP 4 (c) The types of interactions between the amino acids of Hydrocortison with FABP 4.

4. DISCUSSION

Reverse Docking is a computing-based methods that can be used to search for patterns of interactions involving molecular docking (drug/ligand) in a potential binding site on a set of clinically relevant macromolecules targets. The results of reverse docking between proteins Fatty acid-binding proteins 4 (PDB ID: 3P6H) resolutions 1:41 Å, with a candidat ligand (EPA), and control ligand (hydrocortisone) using software PyRx 0.8 shows the binding affinity EPA with FABP 4 highest (- 4.2 kcal /mol) than hydrocortisone with FABP 4 (-7.4 kcal /mol). Then results docking visualized using the software PyMol indicates that candidate ligand (EPA), and control ligand (hydrocortisone) is able to interact with the FABP 4 on same binding site (Figs. 1).

Bond and location of the ligand binding site on a protein target was visualized with Biovia Discovery Studio 2016 Client. Results of visualization showed that EPA interact with FABP 4 through bond Alkyl from amino acids Leu 90 (5.18 Å̊) of FABP 4 (Figs. 2). Hydrocortisone interact with FABP 4 through bond Alkly of amino acids Lys 17(3.90 Å̊), bond Unfavorable bump of amino acid Gly 18 (1.95 Å̊) (Figs. 3).

5. CONCLUSION

This study proved that EPA has potential as an anti-inflammatory agent in the OCD by interact with Fatty acid-binding proteins 4 (FABP 4) that activated anti-inflammatory effects. EPA and hydrocortisone were able to interact with the FABP 4 on the same binding site, binding affinity EPA has a higher bond than hydrocortisone, then it is potential to be an alternative medicine for anti-inflammatory in OCD.

Conflict of interest

The authors have no conflict of interest to declare

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THE PATTERN OF SAFETY AND HEALTH WORK TO PREVENT MUSCULOSKELETAL DISORDERS AT WELDING WORKER IN MAHKAMAH STREET

MEDAN

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Abstract

The welding worker has a potential risk in their work whereas the posture in welding process was not ergonomic. The fatique or musculoskeletal disorders happened at the welding worker shown by their vertebra disorders and some complaint like feel pain in their bone and muscle. The posture like bending over to the floor or squate position in a long duration would giving the fatique complaint at the last process. The purpose of this research was to implement the pattern of safety and health work as the prevention action for decrease the musculoskeletal disorders. This is an observational survey by using the handycam to documented the posture and use the Participatory Action Research approach. Nordic body map questionnaire used to present the mapping of musculoskeletal disorders that happened at the welding worker. The results showed the pattern of safety and health work could be implement at the welding worker such as change the posture with welding in standing posture by using the work bench and do the ergonomic relaxation in 2-3 minutes if the worker feel pain in the part of their body, then do the full ergonomic exercises after the work. The result show that the workers feel pain at their knee, waist, hand, back and shoulder after their work. When they implement the ergonomic relaxation or exercises the musculoskeletal disorders are decrease in 67 % than before and feel productive to continue their work. In conclusion, the ergonomic exercise and relaxation could decrease the musculoskeletal disorders at the welding worker in Mahkamah street Medan. Recommended to the host of welding informal industry to arranged their work time for implement the

ergonomic exercise in daily to decrease the musculoskeletal disorders at welding process.

Key word : welding, posture, musculoskeletal disorders, ergonomic

1. INTRODUCTION

Occupational safety and health is an applied science in every workplace. This application has been regulated in Undang Undang RI No.1 Tahun 1970, concerning work safety, Undang Undang No.14 Tahun 1969 clauses 9 and 10 of the main provisions concerning labor, PERMENAKER No: PER. 02 / MEN 1982 on qualifying welders in the workplace. In general, the achievement of safety and health could not be separated from the role of ergonomic, because ergonomic related to people who work, in addition to the effectiveness and efficiency of work [1,2].

Welding industry is the one of the informal industry sector belonging to Usaha Kecil Menengah (UKM) which still not yet consider the Occupational Safety and Health (OSH) as priority scale. The minimum implementation of OSH generally in UKM covers 91% of 169,524 entities in Indonesia needed to get serious attention and important of awareness about Occupational Safety and Health. This is necessary because workers in informal sector are very vulnerable to accidents and occupational diseases [3].

Welding is defined as one of the techniques of grafting metal, in practice it is not an easy task because it has a very high physical risk, so that in the process requires special skills and equipment, to did not exposed by accident and health problems. [4.5].

Every work always contained hazards including welding process. The hazard of welding can be distinguished by the nature of its work such as electric machine operation, fire, arc welding radiation, welding fume, explosion and noise. The electromagnetic rays generated from welding are non-ionizing radiation consisting of ultraviolet light with wave lengths of 200-400 nm, visible light with wave length 400-700 nm and infrared light with wave lengths between 700-1400 nm. This ray has a

power of at least 100 watt with a wavelength lies 1064 nanometers. In addition, in the process of welding workers generally show a posture that is not ergonomic and irregular way of working. Ergonomic work posture often occurs due to ergonomic work facilities where workers work in an incorrect position like form a bent posture. [6,7,8,9].

The results of the Ministry of Health studies on the profile of health problems in Indonesia showed that about 40.5% of diseases suffered by workers related to their work. According to a study of 9,482 workers in 12 districts / cities in Indonesia, the health problems experienced by workers are musculoskeletal disease (16%), cardiovascular (8%), neurological disorders (6%), respiratory problems (3%), and Ear-Nose-Throat (1.5%) [10].

Jalan Mahkamah Medan is one of the centers of welding workshop in Medan City. In each welding process, it is found that a lot of ergonomic work methods are demonstrated from the posture of a squat in long periods of time due to work done on the floor or over the iron pile. Manual handling process also much happening where workers must move the steels that has been ready or will be welded to a certain place.

Based on the results of preliminary survey, showed that the workers who have abnormalities in muscle and skeleton such as lordosis, increased shoulders, kifosis, and hips are sloping. Workers also feel pain on the body such as part of calf, waist, shoulders and hands. Based on the statement, the purpose of this study was to implement a safe and healthy work patterns as an effort to prevent musculoskeletal disorders complaints.

2. METHODS

This research was conducted at Jl. Mahkamah Medan which is the center of welding business. Population in this research are all welding worker at 22 workshop of welding with total worker counted 93 persons. The sampling technique was done by purposive sampling and there were 51 workers willing in this research. This research is an observation research using handycam. In the application of safe and healthy working pattern used Participatory Action Research approach. The musculoskeletal complaints

felt by the welding workers were obtained using the Nordic Body Map questionnaire. The data obtained were analyzed in descriptively.

3. RESULTS AND DISCUSSION

Overview of Welding Workshop at Jl. Mahkamah Medan

The welding industry of Jalan Mahkamah Medan is a business belonging to informal sector engaged in the product of cafe tents, fences, canopies and others using iron as base materials. Initially in 1973 on Jl. Mahkamah only stands two metal industries, until in 1995 began to multiply until now [11].

The work environment of each welding workshop looks homogeneous where each workshop space is filled with stacking iron, open work space and a bit dark and directly related to the outdoor environment. Noise due to grinding or welding process and welding rays that appear either continuously or intermittently could be seen directly because on average almost all workers are done openly without using a curtain or in a special place. The worker also do their work in naturally without using a complete protective device. The welding worker usually only wears black glasses to reduce the glare experienced while welding, but also workers who didn't use any personal protection during their work.

Ergonomics Hazard at Welding Worker Jl Mahkamah Medan

Figure 1. Grinding Posture

Welding process at Jl. Mahkamah has many risks, especially ergonomic hazards characterized by work postures, layouts, manual handling and working methods. Lay out in welding workshops is difficult to change because the existing room is strived to the maximum extent possible as putting the irons with long or short sizes. To preparation of iron is always placed on the side of the room, so that the work area is dominated in the middle of the room. In this case the stacked conditions are still

understandable as long as the distance for passing is filled.

Manual handling often occurs in the welding process where workers must move the material in the form of iron from one place to another for the continuation of each process. The raised iron is also not in the amount of one but it could be with 5-7 iron bars or other shapes of varying weight. When lifting and transporting, the worker shows a bending and non-ergonomic posture. Late bending activity caused by overloading causes spinal injuries and other musculoskeletal disorders [12].

Working posture formed on the welding process varies. The posture that formed on the worker due to human machine relations that occur in a limited area and surrounded by iron piles. Work postures also vary in motion according to the way work happens during the welding process. Work posture is a decisive point in the analysis of welding workers because it is determined by welding skills. If the working posture is incorrect or not ergonomic it may lead to musculoskeletal fatigue and complaints [13].

Figure 2. Manual handling

Welding process begins from the production pattern making by measuring and cutting iron. Cutting of iron by size is done on the floor by using grinding. As a result, the body's posture is not ergonomic like squatting for a long time, squatting while bowing, even half standing with a bent of approximately 90^0. Working position that requires squatting by folding both legs close to the body in a long time. This pattern of work also tends to cause musculoskeletal complaints.

The next process is iron welding using an electric welding machine. Installation of electricity in each workshop is still very simple according to the capacity of the room and enough risk of short circuit. Welding is also often done with a sitting position, squat and stand where the workers adjust their position to the shape and surface of the iron to be connected through welding. In this welding process only a few workers who use glasses to protect the exposure of light from the welding. The work posture formed during the welding process is also not much different from the position of the

body grinding where the workers do on the floor while sitting squat between the piles of iron and adjust his body with the shape and size of iron to be welded.

After the product is welded then the process of smoothing iron using hand grinding which is directly held and held close to pieces of connected iron. In the process of refinement is usually the workers grind with a standing position and performed in open areas either above the ground or using a work table. This is due to the smoothing process requiring higher precision in order for the smoothed iron joints to improve the quality of the resulting product.

The final stage of the finishing process is usually done in accordance with consumer demand. Generally produced products colored with colorful paint as needed. In the process of iron painting begins by cleaning and smoothing iron dust from the remnants of welding by using sand paper. Work posture during both of these processes is also done in a squatting or standing position and not using a mask.

Ergonomic work postures often cause complaints in the body known as musculoskeletal disorders. Musculoskeletal complaints are formed because of the attitude of static work or posture in continuity. Musculoskeletal Disorders (MSDs) are a set of symptoms related to muscle tissue, tendons, ligaments, cartilages, nervous system, bone structure, and blood vessels. MSDs begin with pain, numbness, tingling, swelling, stiffness, trembling, sleep disturbance, and burning which results in a person's inability to move and coordinate limb movements or extremities thereby reducing work efficiency and loss of work time resulting in productivity work decreases [14].

Musculoskeletal complaints are felt in 51 workers vary almost spread throughout the body. This is supported because the welding workmanship pattern is still done manually. The most high complained is on the shoulders, arms, waist, knees and calves. This is due to the squat position that always experienced welder workers on Jl. Mahkamah could be seen in the following table:

Table 1. Musculoskeletal complaints on welding workers at Jl. Mahkamah

Muskulo skeletal System	Score								Muskulo skeletal System	Score							
	0		1		2		3			0		1		2		3	
	N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%
Upper neck	16	31,4	16	31,4	18	35,3	1	2,0	Necklace	16	31,4	10	19,6	21	41,2	4	7,8
Left shoulder	23	45,1	17	33,3	9	17,6	2	3,9	Right shoulder	15	29,4	11	21,6	23	45,1	2	3,9
Upper arm left	28	54,9	15	29,4	7	13,7	1	2,0	Back	6	11,8	14	27,5	29	58,9	2	3,9
Upper arm right	19	37,3	17	33,3	11	21,6	4	7,8	Waist	5	9,8	13	25,5	28	54,9	5	9,8
Pinggul	16	31,4	19	37,3	13	25,5	3	5,9	Buttock	25	49,0	17	33,3	9	17,6	0	0
Left elbow	27	52,9	15	29,4	9	17,6	0	0	Right elbow	14	27,5	22	43,1	14	27,5	1	2,0
Left under arm	26	51,0	17	33,3	8	15,7	0	0	Right under arm	12	23,5	23	45,1	15	29,4	1	2,0
Left hand wrist	22	43,1	20	39,2	7	13,7	2	3,9	Right hand wrist	15	29,4	25	49,0	10	19,6	1	2,0
Left hand	23	45,1	17	33,3	10	19,6	1	2,0	Right hand	15	29,4	20	39,2	12	23,5	4	7,8
Left thigh	28	54,9	16	31,4	6	11,8	1	2,0	Right thigh	21	41,2	23	45,1	4	7,8	3	5,9
Left knee	19	37,3	24	47,1	7	13,7	1	2,0	Right knee	16	31,4	22	43,1	10	19,6	3	5,9
Left calf	15	29,4	27	52,9	9	17,6	0	0	Right calf	17	33,3	23	45,1	9	17,6	2	3,9
Left ankle	26	51,0	21	41,2	4	7,8	0	0	Right ankle	22	43,1	22	43,1	7	13,7	0	0
Left leg	29	56,9	14	27,5	7	13,7	1	2,0	Right leg	17	33,3	24	47,1	8	15,7	2	3,9

Source: 0=normal; 1=little hurt; 2 = pain; 3= painful

Based on the pain complaint of musculoskeletal that feels by welding worker at Jl. Mahkamah could divide in MSDs risk categories that explained at the table.

Table 2. MSDs Risk Categorize at Welding worker Jl Mahkamah

MSDs Risk Categorize	Frequencies	Percentage
Low	21	41,2
Middle	27	52,9
High	3	5,9
Total	51	100

The complaints experienced by the dominant welding workers are in the moderate category (52.9%) in accordance with the research done on the welding workshop X [15], where the moderate category generally leads to compliance with the degree of weight.

Based on the above table, the risk of MDSs experienced by workers need to be taken as a preventive measure. MSDs disease is a chronic disease that takes a long time to develop and manifest. The longer it works the longer the workers are exposed to the risk of MSDs [16].

To reduce the risk of developing MSDs that can be experienced by welding workers, the workers are trained and encouraged to do light stretching for 2-3 minutes by stretching the sick body while working. After work the worker can do ergonomic exercises for 10-15 minutes before heading home. This gymnastic activity is conducted jointly in the workplace and some workers' opinions state that with the ergonomic gymnastics exercises to know the parts of the body that are sick and able to self-assess its working patterns so far. This is a good achievement where awareness has emerged from workers realizing that during their work has demonstrated unsafe and unhealthy static work patterns.

Based on complaints of pain initially felt in the body, workers acknowledge experiencing pain loss initially felt and pain in the body decreased approximately 67% from previous pain. Workers also feel changes in blood and muscle movements that are better than ever. This suggests that ergonomic gymnastics is one of the best preventive measures in reducing musculoskeletal complaints due to unsafe and unhealthy work patterns.

4. CONCLUSIONS

The pattern of occupational safety and health work to prevent musculoskeletal were doing the streching relaxation and gymnastic activity. The ergonomic exercise and relaxation could decrease the musculoskeletal disorders at the welding worker in Mahkamah Medan in 67%.

Recommended to the host of welding informal industry to arranged their work time for implement the ergonomic exercise in daily to decrease the musculoskeletal disorders at welding process.

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Control of Hazardous Chemical As An Effort For Compliance Criteria of SMK3

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Abstract

The purpose of this study was to determine the appropriate control of hazardous chemicals as an effort to fulfill the criteria in the OHS management system in the welding workshop in PT X East Java.

The research method was used descriptive by giving a clear picture about control of hazardous chemicals in company. Primary data obtained from the observation with the review of compliance criteria in SMK3 or OHS management system and direct interviews to Head of Bureau K3LH and safety officer. Secondary data was obtained from corporate documents, including company policies and commitments, Standard Operating Procedures (SOP) guidelines, and enterprise management systems. Data analysis was completed with presentation in the form of tables and explanations, so it become an information that was easily understood.

The results showed that on the principle of monitoring and performance evaluation there are 3rd element with 46 criteria are fulfilled and 1 criterion was not fulfilled the category of minor findings, namely criteria 9.3.5, and the calculation of achievement level was 97,87%.

From the results of the research can be concluded that the control of hazardous chemicals in the company still not fulfilled the criteria in SMK3, while the appraisal rate was in satisfactory category.

Keywords: hazardous chemicals, OHS performance, OHS risk, OHS management system

1. INTRODUCTION

The rapid advancement of technology boosts every sector of the industries to use the modern technology in doing any of their job. The competition of the industry that becomes more competitive demands every company to optimize the whole resource they have, some of them are financial, physical, human, and technology. Human as the resource becomes one of the keys from the success of a development. One of the way to boost the quality of the human resources is by guaranteeing the occupational health and safety (OHS) of every worker, whether for the worker with the lowest risk of work up to those who needs a lot of concentration and great deal of physical power.

The data of International Labor Organization (ILO) mentioned that at 2010 is noted that in each year, more than 2 million people died for the work accident and disease caused by the workplace, and it happened that about 270 million of work accident per year in the world [6]. In Indonesia, the number of work accident indicates a worrying outcome. This thing is based on the result of research of ILO that Indonesia get the 52^{nd} spot from 53^{rd} in how lacking the management of OHS. The cost that will be spent by the company will be massive, if there is any accident in workplace.

The theory of Domino according to H.W. Heinrich that the cause of work accident, 88% of it is due to unsafe action, 10% of it is because of unsafe condition and 2% of it is unavoidable occurrence [2]. One of the attempt to reduce the unsafe action and the unsafe condition is by doing the risk management. Risk management of OHS is one of the attempt to process all the risks in OHS to prevent the unwanted accident comprehensively, planned, and structured in a good system. The risk management of OHS related to the danger and the risk that exist in the workplace that can cause loss by the company. If this thing happened beyond control, then it can threaten the continuity of the business or the development process [6].

K3 stands for Occupational Health and Safety, abbreviated as OHS. K3 or OHS is a condition that must be realized in the workplace with all efforts based on science and deep thinking to protect the workforce, people, work and culture through the application of accident prevention technology that is done consistently in accordance with applicable laws and standards. Safety is the safety associated with machinery,

tools, materials and processing, platform and environment [8]. It also deals with the way in doing the work and the production process. OHS is from, by, and for every workforce and others within the company and the community. This is very important to prevent the occurrence of work accidents and various types of loss and even death.

The Law Number 1 of 1970 about The Work Safety mentioned that every worker has the rights on protection upon the safety in doing the work for the prosperity and increasing production, as well as the national productivity [9]. Based on that, then the company must guarantee the safety and health of the workers when working and when is located in the workplace. While, the Article Number 87 of Law Number 13 year 2003 about The Employment mentioned that every company must apply the SMK3 that is integrated with the management system of the company [10].

SMK3 is OHS management system which guided by the applicable regulation in Indonesia. Based on Article Number 5 Government Regulation (Peraturan Pemerintah) of Republic Indonesia Number 50 of 2012 about the Application of SMK3 mentioned that every company must apply the SMK3 in its company [5]. The application of SMK3 in companies has the aim to increase the effectiveness of the protection of OHS, as well as the comfort and efficient in pushing the productivity. The number of work accident happened is big enough on the company that can not apply the SMK3, while the company that has already apply the SMK3 is proven to experience a reduction in the number of work accident.

The previous study by Komarul [3] mentioned that the application of Golden Certificate of SMK3 as well as the OHS in company of Kertas Leces Probolinggo has already reducing the number of unsafe action and the work accident due to the unsafe action effectively for the 2011. While the result of risk scoring in working process in PT X of East Java, that generally the danger is in the category of risk in the level of II, III, and IV. For example, the working in height, operational of forklift, install/dismantling scaffolding, cutting, welding, and grinding. On the process of welding, there is the use of chemical that is acethylene and lubricant oil. This needs the monitoring and the control related to the storing and the use of such hazardous chemicals in workplace. The activity of the monitoring and the control is done by the authorized officer that is

competent. This is intended that the officers in charge upon the control of hazardous chemicals based on Government Regulation of Republic Indonesia or PP RI Number 50 of 2012 [5] is someone that has the special certificate and expert of OHS in chemistry.

The practice of the OHS management system in work most be monitored regularly from time to time. This is expected to ensure that the system working properly according to the planning. Based on the Government Regulation of Republic Indonesia Number 50 of 2012 [5], the activity of monitoring and evaluation of working of OHS is done through checking, testing, and measuring as well as the internal audit. All the activities done by the competent resources. If the company do not have the human resources to do the activity of monitoring and evaluating of the occupational safety and health must be reported regularly. This report is then used to do some action of repairing.

PT X has applied SMK3 that is integrated with the management system of the company. The application of SMK3 is done in every process of the work, while monitored by the division named K3LH or OHS and environment (OHS&E). HSE of PT X has socialized the programs of K3LH to all of the workers. There is the HSE plan that functions to increase work and the commitment of application management system in the company, as well as there is the practice of internal audit from that division, as well as the external audit. Therefore, the further research is needed about the control of hazardous chemicals as the attempt to fulfill the criteria based on the Government Regulation of Republic Indonesia Number 50 of 2012 [5]. While the purpose from the practice of this research is to find out the correct control of hazardous chemicals as the attempt to fulfill the criteria in SMK3.

2. Methods

The location for this research is in the workshop of the welding of PT X East Java. The time of this research is on February until March of 2017. The method used is the descriptive, because it has the main purpose of this study is to create a picture or the description about the condition objectively to solve or to answer the question that faced in the situation recently. This is intended because the result will give the clear

and correct picture about the control of the hazardous chemicals as the attempt of fulfilling the criteria of SMK3 or OHS management system based on the Government Regulation of Republic Indonesia Number 50 of 2012 [5].

The primary data in this research is gained from the result of the observation and interview directly. The data obtained by doing some review on the practice of monitoring and evaluation of the work of OHS in company and based on the document related that occur in the workshop of welding of PT X, as well as adjusted with the condition on site or in workplace. Observation done by using the checklist sheets of criteria upon the application of SMK3 based on Government Regulation of Republic Indonesia Number 50 of 2012 [5]. The direct interview done by using the instrument in the form of structured guideline of interview that composed based on the Attachment II of this Government Regulation that is to the Head of OHS&E and Human Resources Bureau and safety officer. The secondary data obtained from the archive documented by this company, such as the organization structure, company policy and commitment of the leader, Standard Operating Procedure (SOP), company management system, and the related documents.

The data have been obtained then processed and analyzed with the base theory and presented in the form of description, so that it becomes an information that is easy to understand. The data analysis is also completed with the data presentation about the scoring towards the fulfilling of the criteria of practice of occupational monitoring and evaluation of OHS in the form of table, as well as the reference and other sources about the practice of SMK3 in the company. It is so that it can help to solve the existing problem. The conclusion of the data analysis is then will be used as the base to give a suggestion of repair that hopefully can be the consideration for the company.

The scoring upon the company based on the criteria that according to its characteristics, divided into three categories as follows:

a. Critical category

   Classified as the critical category if there is finding that cause fatality/death.

b. Major category

Classified as the major category if the company does not meet the requirement of the ruling constitution, do not practice one of the principles of SMK3 and there is a minor finding for one criteria of audit in several location.

c. Minor Category

Classified as the minor category if the company is not consistent in fulfilling the requirement of the ruling constitution, standards, and the guidance as well as other references.

3. RESULTS

The elements found in the principles of monitoring and evaluation of work of OHS is the monitoring standard; reporting and repairing of lacks; material processing and its mobility; the data collection and usage; as well as the checking or audit of the OHS management system. The fulfilling criteria that occurs inside each of the elements on the practice of monitoring and evaluation for the work of OHS in PT X presented in Table 1 below.

Table 1. Result of Fulfillment of Criteria in the Practice of Monitoring and Evaluation for the Work of OHS in PT X East Java 2017

No.	Element	Sub-Element	Criteria Fulfilled	Not Fulfilled (Minor)
..	Monitoring Standards	7.1 Checking for danger	7 criteria	-
		7.2 Monitoring/measuring the workplace	3 criteria	-
		7.3 Tools Checking/Inspection, measuring and testing	2 criteria	-
		7.4 Monitoring upon the health of Employee	5 criteria	-
2.	Reporting and repairing for the lacks	8.1 Reporting of danger	1 criteria	-
		8.2 Reporting of accident	1 criteria	-
		8.3 Checking and study of accident	6 criteria	-
		8.4 Handling of problem	1 criteria	-
3.	Material management and	9.1 Handling manually and mechanically	4 criteria	-
		9.2 Transporting system, storage and	3 criteria	-

No.	Element	Sub-Element	Criteria Fulfilled	Not Fulfilled (Minor)
	displacement	disposal		
		9.3 Controlling upon the hazardous chemicals	4 criteria	1 criteria
4.	Data collection and usage	10.1 Note of OHS	4 criteria	-
		10.2 Data and Report of OHS	2 criteria	-
5.	Checking of SMK3	11.1 Internal audit	3 criteria	
	Total		**46 criteria**	**1 criteria**

Based on Table 1 above, it can be found out that from 47 criteria of scoring in practice of monitoring and evaluating the work of OHS PT X has fulfill 46 criteria and there is 1 criteria that is not fulfilled with the minor category, that is in the criteria number 9.3.5. The data of the result upon the study indicates that from the five elements in the principles of monitoring and evaluating the work of OHS, there are 46 criteria that is fulfilled and 1 criteria that is not fulfilled (minor category). Then the calculation upon the level of achievement for the practice of monitoring and the evaluating the work of OHS in PT X is as follows:

$$\frac{\text{46 criteria fulfilled}}{\text{47 criteria}} \times 100\% = \mathbf{97,87\%}$$

Based on the calculation above, then the score achieved in the practice of monitoring and evaluating the work of OHS is 97,87%. Therefore, PT X is in the classification of “Satisfactory” in term applying the criteria.

4. DISCUSSION

The monitoring and the evaluating the works of OHS is the requirement in applying the SMK3 or OHSMS that can be used to ensure the practice of OHS in the company works properly and according to the planning. Ramli argued that the principle of monitoring and evaluation of OHS can be used to find out if there is any unwanted violation so

that later can be repaired immediately [6]. In the principle of monitoring and evaluating the work of OHS, there are 5 elements with 14 sub-elements, and the total criteria are 47 points. The scoring in practicing the monitoring and evaluating the work of OHS in the company can be done by identifying and evaluating the fulfilling the criteria mentioned in every elements of practice of monitoring and evaluating the work of OHS.

PT X has the total employees of more than 200 persons and there are some jobs with relatively high risk of practice so that the scoring upon the practice SMK3 is needed by scoring the monitoring and the evaluation of the work of OHS in every activity and working program that is used. Based on the result of interview with the safety officer, it is found out that the HSE has done the monitoring upon the practice of all program of OHS&E regularly in every month. The result of the monitoring activity done then recorded and arranged into a monthly report. The result of the monitoring and evaluation of these programs is then handed to division of the company.

PT X has some certificates. Some of them are audit result from implementation of SMK3 on 2015 with the category of satisfactory, certificate of Zero Accident, Audit 5R, and PROPER. Internal audit was done by the division of K3LH that done regularly, that is twice a year. The result of this internal audit then becomes the evaluation to improve the lacks and violation existed. The monitoring and evaluation of the work of OHS has been done in accordance to the requirement mentioned on the Government Regulation Number 50 of 2012 [5], that all company must do the monitoring an evaluation of the work of OHS, which covers the internal audit as well as the checking, testing, and measuring. The procedure of practice are as follows:

a. The involved personnel must have the experience and the qualification.
b. The record of checking, testing, and measuring that is on process must be kept and available for the management, workers and working contractor of related fields.
c. Sufficient testing tools and methods must be used to ensure the fulfillment of the OHS standards.

d. The repair must be done immediately whenever any violation found upon the requirement of OHS from the result of checking, testing, and measuring.
e. The sufficient investigation must be done to locate the cause of the problem from an incident.
f. The findings must be analyzed and studied further.

Monitoring Standards

Bird and Germain in the theory of Loss Caution Model focuses on the importance of the role of to prevent and controlling the accidents, that possibly seen as uncontrollable in a complex situation by using the advancing technology [1]. This theory is more prioritizing the direct relationship between the management with the cause and effect from the accident and the multilinear interaction from the order of factors of cause and effect. This theory also explained that the failure in control also influences the occurrence of work accident, including inside is the lack of strength upon the policy and standard of working program. If the policy, rules, and standard do not working well, then unsafe action and unsafe condition might still happen frequently.

The identification of unsafe action and unsafe condition is done through the Hazard Observation (HO), safety patrol, and inspection. The checking or inspection upon the working place and the way employees work is done by the competent safety officer that is properly assigned to and is able to identify danger. This action is done regularly at least monthly. There is a schedule and procedure of operation for the inspection, including the 5R, HO, and JHA. This is according to procedure of Standard Operating Number 2 UA 002 about The Identification of Aspects and Effect of K3LH, SO Number 2 UA 019 about Monitoring and Inspection of K3LH; SO Number 2 UA 036 about the Monitoring of Workplace and Condition of Surrounding, and SO Number 2 UA 049 About Inspection OHS as well as the Surrounding Environment.

The findings of mismatch obtained from the activity of the safety patrol and the inspection are then recorded and is made into a report as well as informed and distributed to the concerned team. This is proven with the document of Memorandum

BO.06/36100/I/2017 about the Follow-up upon the Findings of Safety Patrol. Then, it will soon followed-up in the period of time according to the capability and the deal made together with the HSE. The report is also handed to the P2K3 or organizing committee of OHS according to the needs to be delivered and discussed in the meeting of P2K3 related to the result from the inspection, whether the findings about violation, achieving target, boosting the work and productivity, as we as the follow-up and the repair done from the result of checking and monitoring of K3LH.

Reporting and Repair of Lacks

The reporting of danger upon safety and health as well as the environment has done by the HSE team and the head of Workshop PT X that is through the hazard observation, as well as the danger identification and the risk grading mentioned in the SO Number 2 UA 002. The procedure and rules about the way to report and investigate a case of work accident as well as the recording of the incident in PT X is mentioned in SO Number 2 UA 017, also in SO Number 2 UA 023 about the Reporting of Accident or the HSE report. In such report, it is contained the cause and effect of a occurrence of the work accident or the sickness caused by the work, also supplemented with the recommendation and the schedule of action of repair as the follow-up for the recovery.

Material Management and Displacement

PT X has the written and documented procedure related to the handle of materials and workplace, such as the SO Number 2 UA 002 about the Identification of Aspects and the Effects of K3LH, SO Number 2 UA 005 about the Control or Processing the Domestic Liquid Waste, SO Number 2 UA 009 about the Processing of Dangerous and Toxic Waste or B3, SO Number 2 UA about the Readiness and Responsive upon the Emergency of Oil Spill in company Area, and SO Number 2 UA 052 about the Handle of Housekeeping or 5R (Sort, Set in Order, Shine, Standardize, Sustain).

PT X has kept records of expiration and safe placement as a requirement in the fulfillment of SMK3 on criteria about the control of damaged or expired materials Besides, there also the document of MSDS (Material Safety Data Sheets) that discuss about the safety of materials and how to handle it according to the rules of the constitution, as well as supplemented with clearly tagged label on the hazardous chemicals. On the workplace that contained hazardous chemicals there are some signs of warning as one of the requirements of the ruling constitution, SO, and company procedure. The procedure or the document of MSDS then stored orderly on the shelves of document or the company manuals in the HSE room. Therefore, all important documents or procedures can be easily obtained and reached by the parties in need.

The criteria 9.3.5 in the fulfilling of implementation of SMK3 based on the Government Regulation of Republic Indonesia Number 50 of 2012 [5] that is included in the element of material processing and its mobility, stated that the handle of hazardous chemicals is done by the competent and authorized officer. The handling of the hazardous chemicals in PT X has done by the competent officer who is a graduate from the chemistry study program. This officer is the delegation from division of K3LH PT X. However, this officer has not yet acquire the license or the certificate of expertise for example the certificate of expert chemist so that in this case is a minor category finding in that certain criteria.

Data Collection and Usage

PT X has established a draft about the document control and the storage of records or notes of K3LH. This can be seen on the master list of records or the list of all document of SO owned and its location of storage. This SO list is mentioned in the standard operational procedure of K3LH (Project Environmental Document, Health and Safety Plan, Number 9500-12-013-PRO-001). Master list in company is supplemented with the note of revision and the date of revision of the document of procedure. Besides, there is also the Letter of Order Number Sprint/027a/36000/II/2017 about the Control of Document in SO, which inside it there are some procedure of practice in identification,

collection, archiving, maintenance, storage and replacement upon the document of OHS according to the requirement of fulfillment in implementing the SMK3.

Checking of SMK3

The practice of internal audit SMK3 of PT X is done twice a year regularly. The internal audit is done to check the suitability of the planning and determine the effectiveness from every existing activity or program. The practitioner of this auditing is called s the auditor. Internal auditor is the officer that own the certificate as an auditor and has the authority as well as the competence or skill to do some audit internally on all division of the PT X. The practice of internal audit is done by the team of OHS division PT X that has owned the auditor certificate of SMK3. The result of the internal audit are then composed into a report of audit and then distributed to the concerned party, including the assistant manager and HSE to the workshop or the supervisors, and other officers concerned on each division of PT X. From the composed report, monitoring is done to ensure that there has been actions done in order to repair as the follow-up from the findings of the audit.

The Level of Achievement in Scoring the Monitoring and Evaluating the Work of OHS in PT X East Java

The scoring category for the fulfillment of the implementation of SMK3 based on the Government Regulation of Republic Indonesia Number 50 of 2012 [5]. In which the level of achievement of 0-59% is classified in the achievement of “Lacking”, the score of 60-84% is classified as “Good”, and the score of 85-100% is classified as “Satisfactory”.

Based on the result of the study, it can be concluded that the score of OHS implementation is 97.87%, it means that the PT X has implement SMK3 in the level of “Satisfactory”. One of the goal of implementing SMK3 based on the Government Regulation of Republic Indonesia Number 50 of 2012 is to prevent and reduce the number of work accident as well as the sickness due to the work [5]. The consistent

implementation of SMK3 can be useful as the protection for the workers. PT X has applied management system of occupational safety and health to achieve zero accident. However, it is undeniable that there are still some danger potential and risks in each processes of work or production.

5. CONCLUSIONS

Based on the result of the study, then the following conclusions can be drawn:

a. On the principle of monitoring and evaluating the works of OHS PT X has fulfill all criteria in the element of monitoring standards, the element of reporting and repairing for the lacks, the elements of data collection and usage, and the elements of checking SMK3, also 11 criteria in the elements of material management and displacement. It means that there are 46 criteria that is fulfilled out of the 47 total criteria that needs to be fulfilled.
b. The implementation of monitoring and evaluating the works of OHS in welding workshop of PT X was done by the safety patrol. The tools inspection, the internal audit SMK3 along with the report of findings for incompatibility as well as the repair, also the medical checkup of the workers located in high potential of danger, locking system (Lock Out-Tag Out), compensation records, and the health rehabilitation of the workers mentioned in the investigation report of work accident.
c. The minor finding in the scoring of the practice of monitoring and evaluating the work of OHS is in the criteria 9.3.5, that is the welding workshop of PT X has acquired the procedure of storage, handling, and the mobility of hazardous chemical, as well the marking system or the tag labelling done by the authorized officers that is competent with the chemistry educational background, yet the officer has not acquired any special certificate (expert of OHS in chemistry).
d. The result of the calculation upon the level of achievement of the practice of monitoring and evaluating the work of OHS is 97,87% so that it can be concluded that PT X is in the category of “Satisfactory”.

Based on the conclusions above, then several following suggestions might be given for the company.

a. Keep the commitment upon the management system and the policy of OHS to be sustainable so that the practice of SMK3 can work effectively.
b. Keep doing the management of review or the Board of Direction (BOD), HSE and P2K3 meeting regularly to increase the work of SMK3 in along with the evaluation programs.
c. Assign or point one or more officers in handling the hazardous chemicals and giving the training upon the danger and the way to handle or control that, as well as planning the certification program for the specific skill that is suitable that is the OHS experts in chemistry and the OHS of chemistry officers based on the Decree of the Minister of Employment of Republic Indonesia Number Kep.187/MEN.1999 [4] about the control of hazardous chemicals in workplace. This is related to the use of acethylene in the welding working process and the lubricant oil used in the workshop.
d. To keep up with the level of achievement gained in practicing the monitoring and evaluating the work of OHS so that it will still be in the “Satisfactory” level.

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Ethical Approval

The study was approved by the institutional Ethical Board of the Public Health, Airlangga University. All subjects were fully informed about the procedures and objectives of this study and each subject prior to the study signed an informed consent form.

Competing Interest

All authors have no competing interest.

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Crash Characteristic and Factors Associated with Injury Severity Among Road Traffic Accident (RTA) Victims.

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Abstract

Injuries and deaths caused by road traffic accident have become a major public health and socioeconomic problems in Indonesia. In 2010-2015 there were 98.019 road traffic accidents occurred in Indonesia, inflicted more than 242 billion rupiah financial losses each year. Denpasar city has the highest accident and fatality rate in Bali Province, caused 105 (15,2%) fatalities and 207 (30%) major injuries.

This is an analytical *cross-sectional* study, using a quantitative approach. This study aims to analyze the contributing factors associated with injury severity among road traffic accidents victims in Denpasar, Bali. Data were collected from 401 accident reports and 690 victim records in Traffic Accident Unit, Denpasar Police Department throughout the year 2016.

The results revealed, 401 accidents caused 690 injury victims, most of them were males (70.72%) and occurred in 18-40 age group category (62,03%). *Chi-square* analysis showed, there's a significant association between educational level, type of crashes, type of vehicle, opponent's vehicle, road user category and helmet usage status with injury severity. Compared with the single vehicle accident, in multiple vehicles crashes there is 2.9 higher risk to affect a serious injury (P 0,01 CI 1,44-2,95). Non-helmeted motorcycle rider have 2.8 times higher risk to suffer serious injury (P 0.05 CI 1,38-5,73). Regarding the road user category, pedestrian have the highest risk to suffer a serious injury. In multivariate analysis, the result has shown a

significant association between helmet usage status and opponent's vehicle type with injury severity.

Using a protective equipment can reduce the injury risk, evaluation in driving license issuance also needed to reduce the risk of existence ineligible motor-vehicle user. An educational approach, prevention and promotion also needed to inform the public about safety riding/driving behavior on the streets.

Keyword: ***Crash Characteristic, Fatality, Injury Severity, Road Traffic Accidents.***

1. BACKGROUND

Nowadays, transportation has become a primary needs for each individual, and the transportation needs consistently tend to increase in a huge number. In 2015 there are 121,394,185 units of vehicles in Indonesia, with 9.13% annual growth rate. This pattern can bring a positive impact for the fulfillment of needs in society. But also gain undesirable negative effects, such as traffic jam, high density, and the occurrence of road traffic accidents (RTA).

Throughout 2010 to 2015 there were 98,019 road traffic accidents (RTA) per year, inflicted more than 242 billion rupiahs financial losses per year (Indonesian Statistical Department, 2015). In 2015, RTA caused 26,495 fatal injuries (16.44%) followed by 23,937 serious injuries (14.85%), more than 50% victims came from the productive age group (15-21 years).

Bali province has 4,056,300 total population and recently claimed there were 3,961,644 vehicles recorded. Based on the ratio of road length to the number of vehicles, Bali has a ratio of 503.37. This indicates every 01 km of roads serve more than 500 vehicles. (Department of Public Works and Housing of the Republic of Indonesia, 2013). In 2016, there were 1628 traffic accidents in Bali. Caused 3.3 billion rupiahs financial losses, inflicted more than 2,957 victims, consisting of 16.5% fatality, 12.07% major injuries and 71.42% of minors-injuries. Denpasar city contributes the highest number of traffic accidents. From 401 traffic incidents occurred, resulting in 105 deaths, 207 victims who suffered serious injuries and 380 victims of minor injuries, estimated causing 831 million rupiahs losses.

2. METHOD

This is an analytical cross-sectional study, using a quantitative approach. This study aims to analyze the contributing factors associated with injury severity among road traffic accidents victims in Denpasar, Bali. Data were collected from 401 accident

reports and 690 victim records in Traffic Accident Unit, Denpasar Police Department throughout the year 2016.

3. RESULT & DISCUSSION

Accidents Characteristic

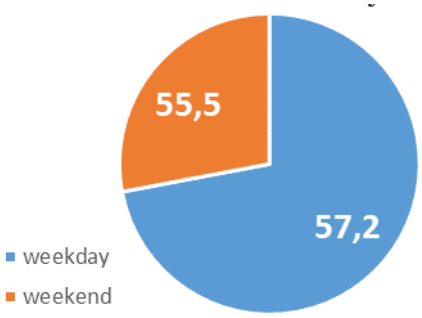

Figure 1. Accident characteristic based on type of week.

As shown in figure 1, the higher accident occurred on the weekday with a rate of 57.2. A study conducted by Kiteywo [9], showed the same tendency. The majority (72.2%) of motorcycle accident occurred on Monday to Friday, with the highest percentage on Monday (16.4%) and also on Friday at 16.4% [9]. Most of the accidents occur on weekdays are due to the fact that on the weekdays people tend to go to work a lot and it is open market days [16]

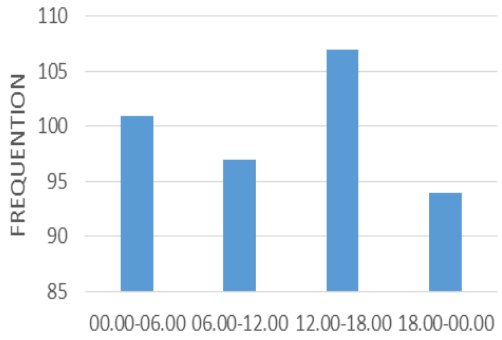

Figure types.

Figure.2 shown, most of the accidents occurred at 12:00pm-18:00pm which amounted to 107 events (26.82%). The most accidents occur in the afternoon and in the morning, in the afternoon is the hours of work home where riders tend to rush to get their home [9].

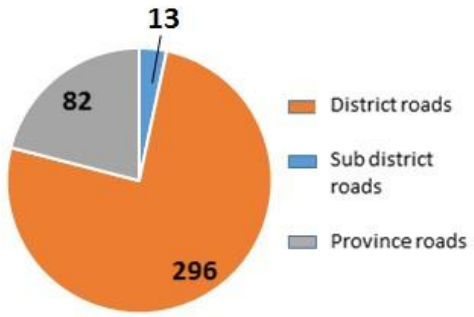

Figure 3. Accident characteristic based on types of roads.

According to the road types, most of the accidents occurred in the district roads (296 incidents/79.70%). District- roads in Denpasar City have the greatest frequency.

There are 486.08 km (83%) district roads, 46.570 km (7.9%) of national roads and 52, 1 km (8.9%) provincial roads (Denpasar Central Bureau of Statistics, 2015).

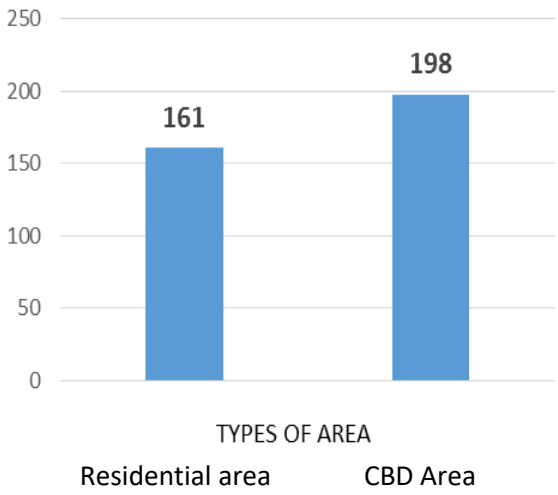

Figure 3. Accident characteristic based on types of areas.

Most of the crash accidents occurred in the central business district area (56.73%). In a study conducted by Tulu, .et al [21] (2013), the injured victims of traffic accidents in Ethiopia, there were 6.290 traffic accident victims (21.4%) came from the central business district area incident. Compared with the residential area, CBD area has a larger number of injured victims.

Table 1. Sociodemographic association with injury severity among RTA victims.

Variable		Injury Severity						
		Minor injury		Serious injury			*P*	
		n	(%)	n	(%)	n	*Value*	PR (CI 95%)
Sex								
	Female	173	85,64	29	14,36	202		
	Male	410	84,19	77	15,81	487	0.63	1.10 (0.74 - 1.63)
Age								
	≥ 25	403	85,56	68	14,44	471		
	< 25	180	82,57	38	17,43	218	0.31	1.20 (0.83 - 1.73)
Driving Licence								
	Have driving license	268	87,01	40	12,99	308		
	No driving license	137	81,55	31	18,45	168	0.10	1.42 (0.92 - 2.18)
Educational Level								
	≥ Senior High school	233	86,62	36	13,38	269		
	< Senior High school	48	75,00	16	25.00	64	0,02	1,86 (1.10 - 3.14)

Sex

Most of the victims were male (70,22%). The male victim has 1.1 times higher risk than the female to be seriously injured, but there was no significant association (P = 0.63 (95% CI 0.74-1, 63). Similar result was found in a study conducted by Wang, et al., [22] (2017). There was a larger distribution of male

victims, but no statistically significant associations (P = 0, 18) (Wang, et al.,[22] 2017). Another study conducted by Cordellieri, [2] showed, there was a significant difference in gender variables with P=.001, men's group had higher values of inattentive driving scores and higher values of violations while driving violation P <0.001[2].

Age

Young road user (under 25 years old) has 1,2 times higher risk to suffer a serious injury than the older group, but no statistically significant relationship was found (P 0.31 (95% CI 0.83-1, 73). The same results were also found in a study conducted by Kiteywo, [9] (2016) aimed to discover the characteristics of accidents and injury patterns in Kitale Hospital Kenya. Found no related distribution between injury severity and age group. In adolescence group, there is a tendency to assert their freedom and enjoy a more intense social life [14].

Educational Level

Victims with lower education level have 1.86 times higher risk to suffer a serious injury (P=0.02 (95% CI 1.10 to 3.14). The same result was found in a study conducted by Sami., Et al. [17] (2013), aims to examine the relationship between education and age levels as a causative factor in the incidence of traffic accidents in Fars Province Iran, There is a significant relationship between education level and fatality rate in traffic accident victims (X2=275.98, P<0.0001)[17].

Driving Licenses Status

In this study showed, the road user without driving license has 1.1-times higher to suffer serious injury, but no statistically significant relationship was found (P=0.11 95% CI 0.92-2.18). A different result was found by Solanki & Mittal, [18], there was a significant relationship between driving license status and injury severity (P=0.001) [18].

Motorbike user who does not have a driving license has a tendency to not use the helmets and other safety equipment, so this would increase the severity risk of injury during an accident [13]. In a study conducted by Elliot, et al. [4] found that the driving license status has a significant relationship with helmet usage behavior (P 0.001)[4].

Table 2. Association of Type of crash, type of vehicle and opponent vehicle with injury severity among RTA victims.

Variable	Injury severity							
	Minor injury		Serious injury		Total	*P Value*	PR	CI 95%
	n	(%)	n	(%)				
Type of crashes								
Single vehicle	72	94,74	4	5,26	76			
Multiple vehicle	391	84,63	71	15,37	462	0,01	2,91	(1.09-7.76)
Type of vehicle								
Four wheel vehicle	35	94,59	2	5,41	37			
Two wheel vehicle	508	85,67	85	14,33	593	0.00	16	(4.42-138.25)
Opponents vehicle								
Two wheel vehicle	347	88,52	45	11,48	392			
Four wheel vehicle	183	76,25	57	23,75	240	0,00	2,06	(1.44-2.95)

Type of Crashes

In accidents that involved more than one vehicles showed, there is 2.9 times higher risk to suffer a serious injury than the single vehicle collision. Based on chi-square test results found a significant association (P 0.01 (95% CI 1.09-7.76). According to Khorashadi et al. [8] there is a -

different injury level between single and multiple accidents, in accidents involving more than one vehicle is more likely to experience more fatal result [8]. Hassan,

(2015) found, there was a significant difference between single and multiple vehicle crashes.

Type of Vehicle

Chi-square analysis showed Prevalence ratio/PR =16 (P 0.00 CI 95% 4,42-138,25), which means the motorcyclist has 16 times higher risk than four-wheeled vehicles user to suffer serious injury, the statistical analysis has shown a significant correlation. The motorcyclist has more susceptible risk factors, such as lack of stability and the protection of the passengers. The motorcyclist has 18 times higher risk of death than car user [15].

Hsieh, et al., [7] (2016) higher proportion of injury rates occurred among the motorcycle users. At 1.000.000.000 km distance traveled by motorcyclists, there are 117 motorcyclists deaths. These results show a risk of more than 30 times higher than the car users, where there are only 4 deaths per 1.000.000.000 km distance traveled [3].

Opponent Vehicle

There was a significant relationship between the types of opponent vehicle with the injury severity (95% CI 1.44-2.95). Drivers who crashed with four-wheeled vehicles have a risk of 2 (two) times higher. A study conducted by Torrão, et al., [20] (2014), which aims to determine the relationship of vehicle type and type of collision to the severity of injury in two-vehicle collisions, found that the types of opponent vehicle was a significant factor with the injury level in multiple crashes (P<0.038) [20].

Lefler, [10] (2002), found that pedestrian who was hit by light truck vehicle (LTV) had a higher risk of injury than the victim who was hit by a smaller vehicle. Pedestrian who was hit by LTV had a higher likelihood of death (OR=1.31 CI=0.88-1.94). It is assumed that on LTV type has a bigger shape, size and also higher weight [6].

Table 3. Association of Road user category & Helmet Status with injury severity among RTA victims

Variable	Injury severity							
	Minor injury		Serious injury		Total	*P Value*	PR	CI 95%
	n	(%)	n	(%)				
Road user category								
Passenger	128	89,51	14	10.49	143		**REF**	
Driver/rider	415	85,22	72	14,78	487	0,03	1,05	(0,74–4,65)
Pedestrian	40	67,80	19	32,20	59	0,02	1,37	(1,04-3,03)
Helmet status								
Helmeted	115	87,12	17	12,88	132			
Non-helmeted	14	63,64	8	36,36	22	0.005	2.82	(1.38-5.73)

Helmet Usage Status

Chi-square analysis showed PR=1.05 and 1.37 (passengers as the comparison reference) (P=0,02 95% CI 1.04-3,03) (P=0,03 95% CI 0,74–4,65). Which means there is a significant correlation between the road user category with the injury severity. Driver/rider has 1.05 higher risk for serious injury than passengers. Furthermore, the pedestrian victim has 1.37 higher risk to suffer seriously than the passenger group. A higher proportion of injured victims of road traffic accident occurred among the driver/rider category [9]. Markogiannakis, et al., [12] (2006), found a correlation between differences of road user category, age, and gender with the injury profile at Herakleion Hospital, Greece. Higher frequencies of craniocerebral injuries were dominated by riders and pedestrians group.

Road User Category

There was a significant relationship between helmet status with the injury severity. The motorcyclist who does not use helmets has 2.8 times higher risk to suffer a serious injury (P 0.005 (95% CI 1.38-5.73). Most of the motorcyclists who did not use helmets during the accident, suffered head injuries amounted 85.6% [9]. Head injury is the most common cause of deaths due to road traffic accidents, the head becomes the most vital and vulnerable organ to fall on injury [19].

Research conducted by Branas & Knudson, (2001) concerning on the regulation of helmet usage with the mortality rates on motorcyclists in 50 US states in 1994-1996. Discovered that the mortality rate in states with strict regulation of helmet usage indicates a lower rate of mortality than the unregulated states (P = 0.740) [1].

Multivariate Analysis

Table 4. Forward selection multivariate analysis result.

Variable	**OR**	**95% CI**	**alue**
Opponent vehicle			
Two wheeled			
Four wheeled	7,36	(2,49-21,70)	,000
Helmet usage status			
helmeted			
non helmeted	5,69	(1,75–8,49)	,004

Based on the results of multivariate analysis using forward selection method. Final model showed, there was a significant relationship between the type of vehicle used by the opponent and the status of helmet usage with the injury level of the RTA victims. The motorcyclist who doesn't use helmets during the accident has 5.6 times greater risk of getting a serious injury (OR 5.6 P = 0.004 CI 95% 1.75-8.49).

At the same time, opponent vehicle variable also showed a similar tendency (OR=7.36 P=0,000 CI 95% 2.49-21.70). The opponent vehicle type was a significant factor of the injury status in multiple crashes accident (P <0.038) [20]. Four-wheeled vehicles have the weight, size and also a larger shape than a motorcycle. Drivers who use lighter vehicles have a higher risk of injury while crash with a larger and heavier vehicles. In this case, the likelihood of serious injury will be higher as the vehicle size differences and vehicle weight enhancement [11].

4. CONCLUSION

This study has shown that the opponent vehicle types, vehicle types, type of collision, road user status, level of education and the helmet status have a significant relationship with the injury severity among road traffic accident (RTA) victims. With respect to the multivariate analysis, the opponent vehicle type and the helmets usage status proved a significant relationship to the injury level.

5. SUGGESTION

Using a protective equipment can reduce the injury risk, evaluation in driving license issuance also needed to reduce the risk of existence ineligible motor-vehicle user. An educational approach, prevention and promotion also needed to inform the public about safety riding/driving behavior on the streets.

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ACCIDENT DATA ANALYSIS IN GEOENGINEERING DIVISION PT FREEPORT INDONESIA BASED ON HUMAN FACTOR ANALYSIS AND CLASSIFICATION SYSTEM-MINING INDUSTRY FRAMEWORK (HFACS-MI) METHOD 2015

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Abstract

Human Factor Analysis and Classification System (HFACS) is an accident analysis method which used to see the weakness of each layer on HFACS itself. The layers on HFACS are consist of unsafe act, precondition to unsafe act, unsafe leadership, and organizational influences. At the moment, PT Freeport Indonesia has been doing accident investigation for every single case or accident using internal tools is RCAP (Root Cause Analysis Process) method. This thing is quite sufficient in investigation process in a company. The number of case/accident is quite enough (nearmiss until lost time/restricted duty) in GeoEngineering division 2015 as many as 51 cases, then the author want to see from the other side by using HFACS method which further see the human factor side.

The layers which are on HFACS are unsafe act which consist of error and violation. Second layer is precondition to unsafe act which consist of environmental factor, condition of operator and personal factor. Third layer is unsafe leadership consist of inadequate leadership, planned inapropriate operation, failure to correct known problem and leadership violation. The last layer is organizational influences which consist of resources management, organizational climate, organizational process.

From the analysis result which been done on the cases/accident 2015 in GeoEngineering Division, it's been known that unsafe act has the biggest proportion as many as 106%, precondition to unsafe act 102%, unsafe leadership 16% and organizational influences 10%. The

presentation above is more than 100% because the number of accident causes is bigger than the number of case/accident.

Based on explanation above, the weaknesses which found in each layer of HFACS-MI which been conducted on the accident/case data in GeoEngineering Division is like in the next explanation. In the unsafe act layer, the biggest weakness which been analyzed is related to postural error, risk assessment, misjudgement and procedural violation. In the precondition to unsafe layer, the things which become the biggest weakness are inadequate installation of guard, ergonomic issues, PPE/guard/safety device, physical/mental limitation and the weakness on coordination and communication. In the unsafe leadership layer, the weakness is about inadequate guidance. In the last layer is organizational influences where the thing which become the biggest weakness is about inconcistency implementation of procedure.

Key Words: HFACS, Analysis, Layer, Weakness

1. INTRODUCTION

PT Freeport Indonesia is a mineral mining located in Papua Province, Timika distric. Operation area located from Timika until the highland of Jaya Wijaya. Mining system conducted by two method and they are open pit and underground method. GeoEngineering is one of the support team of underground and provide some Geological, geotechnical, seismics and etc. in 2015 it had happened 51 cases/occurrence in Geoengineering division, experience direct loss and reach USD 6018,17 until December 31, 2015. If we look at the pyramid theory of cost, indirect cost is bigger than direct cost. All accident happened in GeoEngineering Division during 2015 has been investigated as procedur, but the same occurrence still happen in 2016. Therefore it's need to looking for counter measure, what kind of counter measure should be doing to decrease or eliminate those accident. On this thing, the author will conduct analysis of accident using method with different from company usually did. The method used is Human Factor Analysis and Classification System Framework-Mining Industry (HFACS-MI), where this method will see the accident from human side. Its consist of 4 layers they are unsafe act, precondition to unsafe act, unsafe leadership, organizational influences.

2. TEORITICAL REVIEW

Human Factor Analysis and Classification System (HFACS) is a system develop by Reason Model (1990) which seeing active failure and latent failure where it begin develop by US Navy and Marine corps as a tools to analysis the data and accident investigation **[4]**. By seeing the concept of active and latent failure from Reason, HFACS described human error in every level of failure those are unsafe act, precondition to unsafe act, unsafe supervision and organizational influences **[4]**. Below are the explanation for each level.

a. Unsafe Act

Unsafe act level divided into two they are error and violation. Although both have much similiarity, but both of them have a different when rules and regulation in a company have made. Error can described as something "valid" where it happen while conducting a job but failed to get wanted result. While violation generally defi~~nitio~~ned as a behavior which break the rules conducted in purpose. Error in HFACS divided into three parts such skill based error, decision error, perceptual error. While violation consist of routine and exceptional **[1]**.

Error: one of general form of error is decision error where there is conscious, direct to the purpose based on designed, but the provent plan is not suitable or not correct for current situation. Usually often called 'honest mistakes", this things is usually happen because bad procedure execution, incorrect choosen or the simple is there are wrong interpretation or wrong usage of related information **[1]**.

Different with decision error, the second form of error is skill based error its happened because there is no consciousness. For example in operating automatic machine do not need high consciousness to operate. The thing become difficulties in this practical is that the probability of somebody loosing their intention and fail to remember. Result of skill based error is such the broken of scan pattern, failure to activate or inactivate the button, forget the purpose, loss one of the item on checklist. In aviation the lack of behavior and skill (agressive, tentative and control) in one flight can affect the flight safety. Decision and skill based error usually dominate the cause of accident in all error frame. The last is perceptual error happen when input to the neuro degradate or 'unusual" **[3]**.

b. Precondition to Unsafe Act

Precondition generally is failure system with latent character which stay in a long period till contribute to an accident. Precondition to unsafe act consist of environmental factor, operator condition and personal factor **[2]**.

Environmental factor consist of two they are physical environment and technological environment. Physical environment is common stated and see in accident database. Physical environment refers to both operational (equipment, machine,etc) and environmental ambient (temperature, weather, etc). Mine worker often exposure at high temperature which can cause concentration down, dusty roads decrease vision and dehydration, where it all can lead to an accident. Environmental technology related with equipment design and interaction between operator and equipment **[2]**.

Operator condition divided into three parts: adverse mental state, adverse physiological state and physical/mental limitation. Adverse mental state including mental condition of someone which can effect their performance. Example, mental fatigue, boring, disruption, lack of intention, frustration, wrong place of motivation, etc. Adverse physiological state include health and physiological condition which effect employee performance. Such as organ functioning normally, if not functioning normally, it will impact employee performance **[2]**.

Physical/mental limitation, eventhough many people didn't want it, there are some job which sometimes conducted by an employee beyond his capacity. For example, we all can not be a best cricket player in a short time, and we will not have capability either physic and mental to play it complexily, operating heavy equipment correctly by a little experiences. This category refers to situation when individual capability excess the capacity which required by a job **[2]**.

c. Unsafe Leadership

Reason (1990) said that, action of a leader can impact the performance and behavior of an operator. In investigation, the chain of accident cause, leadership factors should be involved **[3]**. Unsafe leadership divided into four category: inadequate leadership, planned inappropriate operations, failure to correct known problem and leadership violations.

Inadequate leadership. A leader responsible to give a chance to an employee to do safe operation. This is conducted by adequate training, supervisory, insentives, guideline, etc.

Planned Inappropriate Operations. This category refers to situation where there are action initiate and place the employee at risk to the intolerate level. Although those condition achievable in emergency situation, but in normal condition is not achievable. For example, a leader assign his/her subordinate to add shift work to cover the shift which is not achieve as schedule. Those example can increase a probability of someone to human error.

Failure to Correct Known Problem. This category refers to condition and behavior which can not received that identifieable, however the counter measure didn't carry out. Inconsistent of action or indiscipline will lead to regulation violation **[5]**.

Leadership Violation. Is the last category in this level, it is situation where a violation of existing rules by a leader. When an employee see their leader do rules violation, so it will impact to organization culture.

d. Organizational Influences

Organizational failure can be investigated further for the lack in highest level. Latent condition at organization level often not appear in accident investigation. Usually this factor is hardly to find unless has deep understanding related with usage organization and also investigation frame. Identification of causing factors at this level can covered over incapability to blame company. This level divided into three category such resources management, organizational climate and organizational process **[5]**.

Resources Management. The most appear of corporate decision related with resources management. Resources management include equipment, facility, money and human. Resources allocation usually based on two objects which opponent each other that is safety and profit. Failure of resources management can happen when there is imbalance comparation of leader and exist employee **[5]**.

Organizational Climate. Refers to some variable which affecting performance, include organization structure, culture and policy. Organization structure usually become the main structure in a company. The way interact between management and employee is become a part of organization climate. Culture refers to behavior, value, belief, and habitual which used as guidelines **[6]**.

Organizational Process. The las category in organizational influences, organizational process refers to decision making taken by leader who take control of operation day by day in an organization. Organization process include creation and distribution of procedure, roster choosen and developing of safety program **[6]**.

3. METHODS

Data. Data research obtained from accident database of GeoEngineering Division during 2015. those data was the data of investigation result which had been conducted using Root Cause Analysis Process (RCAP) method. All investigator had already trained related with that method, and its sure that investigation result is adequate and regard with criteria. The number of case in 2015 in GeoEngineering division as many as 51 cases, from nearmiss to loss time accident. There was no fatality in 2015 in GeoEngineering Division.

Category. All data analyzed by using previous method will be reclassified based on level in HFACS such unsafe act level, precondition to unsafe act, unsafe leadership and organizational influence. Classification conducted independently by researcher according to the level on HFACS using classification table

Analysis. All cases which been analyzed using RCAP method, will be analyzed by researcher using HFACS-MI method and will be grouping into each level of HFACS, Grouping conducted by using microsoft excel and data in each category input manually.

4. RESULTS

Analysis result using HFACS-MI method involving all level, except outside factor level. The table below is the analysis result of accident data carried out in Geoengineering Division.

Percentage of some level can exceed 100% because the analysis result conducted, causes of cases on that level is multiple causes or the causes is more than one in each level.

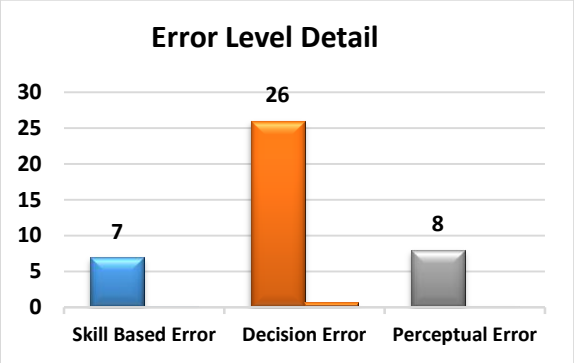
Category	Number of cases (N=51) 51	Percentage
Unsafe Act	**54**	**106%**
Error	**41**	**80%**
Skill Based error	7	**14%**
Decision Error	26	**51%**
Perceptual Error	8	**16%**
Violation	**13**	25%
Routine Violation	13	25%
Exceptional Violation	0	0%
Precondition To Unsafe Act	**52**	**102%**
Environmental Factor	**32**	63%
Physical Environment	26	51%
Technological Environment	6	12%
Condition of Employee	**13**	25%
Adverse Mental State	1	2%
Adverse Physiological State	4	8%
Physical/Mental Limitation	8	16%
Personal Factor	**7**	14%
Communication, Coordination & Planning	7	14%
Personal Readiness/Fitness For Duty	0	0%
Unsafe Leadership	**8**	**16%**
Inadequate Leadership	7	14%
Planned Inapropriate Activities/Operation	1	2%
Failed to Correct Know Problem	0	0%
Leadership Violation	0	0%
Organizational Influence	**5**	**10%**
Resource Management	0	0%
Organizational Climate	0	0%
Operational Process	5	10%

N=51 (N=Case Number/Occurence)

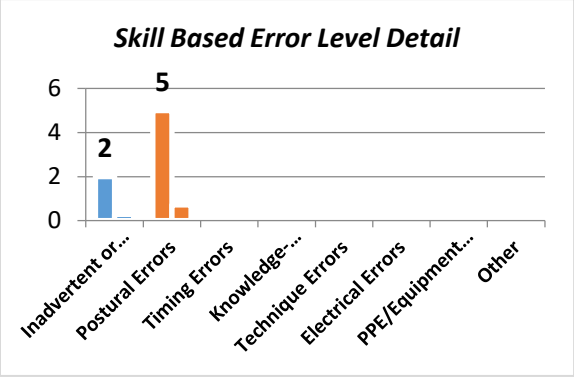
5. DISCUSSION

Unsafe Act

Unsafe act is directly associated with accident. In many cases, unsafe act has a bigger portion compare with other causing factor. So do with the cases analyzed in GeoEngineering division, unsafe act has 54 involveness or 106% from the total of cases (51). in this case, decision error become the biggest weakness point as many as 26 (51%) and followed by perceptual error as many as 8 (16%) and skill based error as many as 8 (14%). While for violation 13 or 25% from cases total. Below diagram is description of unsafe act.



Skill Based Error. Unsuitable operation, incorrect position when conducting a job and incorrect lifting become the weakness point in skill based error. On this table below we can see the each distribution.

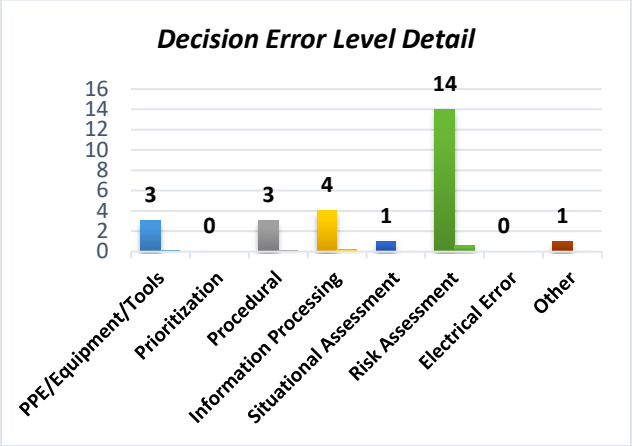


For detail, it is explain each factors which have weakness point on skill based error.

Inadvertent or missed operations	Total
Inadvertent operation of incorrect control	2

Postural Errors	Total
Improper position for task	2
Improper lifting	2
Improper loading	1

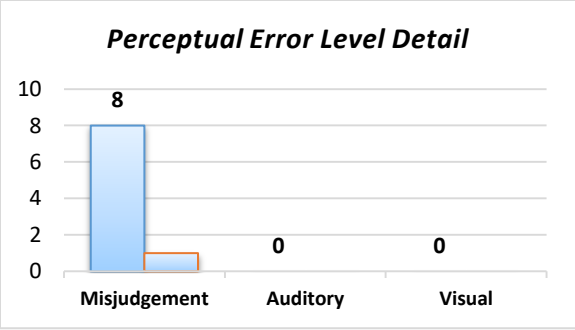
Decision Error. In this case, decision error become the biggest weakness point between another error. The most decision error found is such: inadequate risk assessment, incorrect decision making, failure to conduct precheck inspection, etc. Below diagram show each weakness on decision error.



Detail of decision error, things become the weakness of occurrence in a case such on the table below:

PPE/Equipment/Tools	Total
Incorrect use of equipment	1
Improper placement of equipment or materials	2
Procedural	Total
Improper procedure (i.e. lock out/tag out not done)	1
Failure to take appropriate action regarding known hazard	2
Information Processing	Total
Misinterpretation of information	1
Improper decision making	3
Situational Assessment	Total
Failure to report/correct hazardous conditions	1
Risk Assessment	Total
Inadequate risk assessment	11
Failure to perform pre-start inspection	3
Other	Total
Working in unsafe area	1

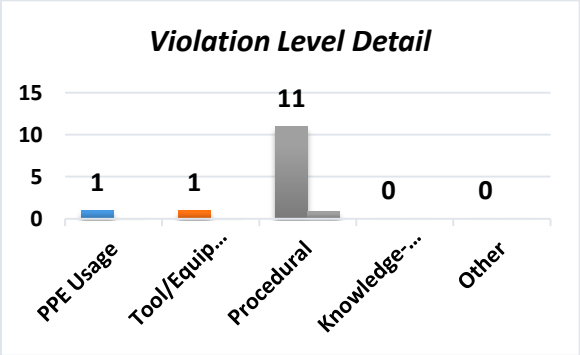
Perceptual Error. Related to employee perception to the capability of correct decision making. From analysis, the most weakness of error is related with error to approximate such distance, deep, weight, etc.



Perceptual error detail on the table below:

Misjudgement	Total
Misjudged distance	3
Misjudged depth/height	1
Misinterpreted/misread equipment	3
Under/over estimation of object's weight	1

Violation. Analyzed violation on this research is violation of applied rules in company. In this cases, the most violation with often break is related to procedures, equipment utilization, equipment operation, dll. Here is the detail ov violation by employee during 2015.

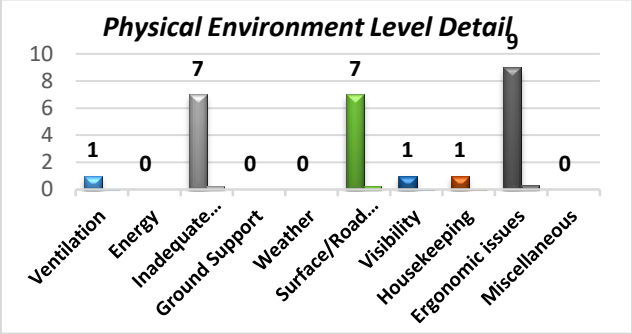


Detail of violation:

PPE Usage	Total
PPE Not used	1
Tool/Equipment Operation	Total
Operating vehicle/equipment at speeds greater than the posted limit	1
Procedural	Total
Disregard for SOP	11

Precondition To Unsafe Act

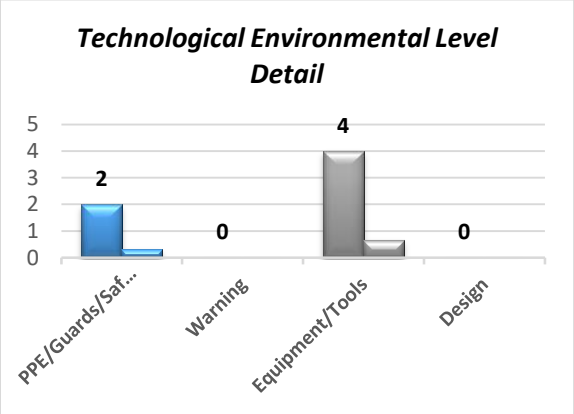
In precondition to unsafe act, the most weak factor is environmental factor, followed by condition of operator and personal factor. In environmental factor, the most found is physical environment and followed by technological environment.



Detail of physical environment:

Physical Environment	
Ventilation	**Total**
Inadequate Ventilation	1
Inadequate Installation	
Labels/warning signs	2
Guards	5
Surface/Road Conditions	
Slippery floors or walkways	2
Slippery roadways	5
Visibility	
Restricted visibility	1
Housekeeping	
Trip hazard	1
Ergonomic issues	
Congested or restricted motion	9

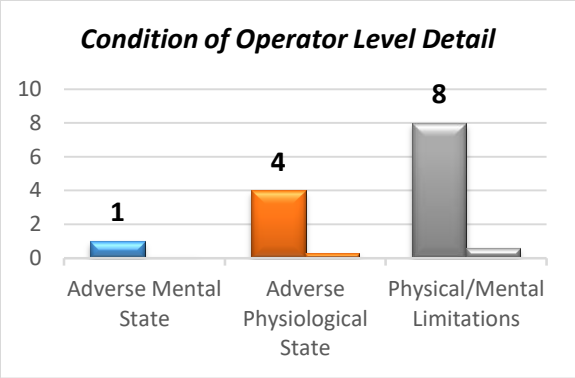
In physical environment, the bisggest weak is related with inadequate installation, road condition or surface and ergonomic issue. While for technological environment, the bigges weak is related with tools and equipment and also PPE/guards/safety device.



For technological environment we can see on the table below:

Technological Environment:	
PPE/Guards/Safety Device	Total
LTA or defective guards or protective devices	1
No guards or protective devices in place	1
Equipment/Tools	
Defective equipment or tools	1
Dysfunctional equipment or tools	1
LTA equipment/tool maintenance	2

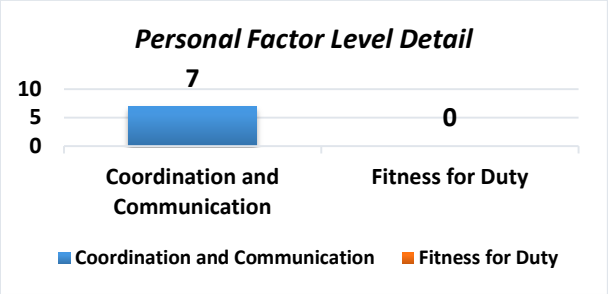
On condition operator level, the most weak factor is physical mental limitation, followed by adverse physiological state dan adverse mental state. At physical/mental limitation part, the most weak factor is like lack of competence, and for adverse physiological state, related with high working load.



Below is the detail of each level in condition of operator:

Adverse Mental State	
Attitude	**Total**
Awareness	
Distraction	1
Adverse Physiological State:	
Physiological Condition	**Total**
Fatigue	
Fatigue due to workload (physical)	3
Fatigue due to lack of rest	1
Physical/Mental Limitations	
Mental Limitations	**Total**
Limited experience/proficiency	1
Inability to comprehend instructions, policies, etc.	1
Physical Limitations	
Lack of competency	2
Lack of proficiency	3
Restricted range of body movement	1

On personal factor level, lack of communication and improper communication between employee become the most weak.

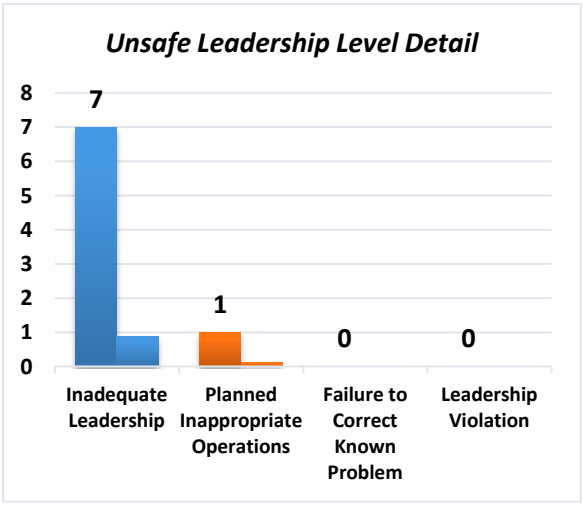


Personal factor detail showed on table below:

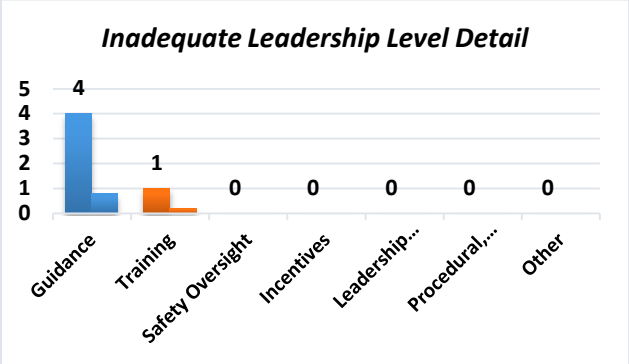
Coordination and Communication Communication	Total
LTA communication of hazards	3
LTA communication b/w workers and leadership	1
LTA communication between work groups	3

Unsafe Leadership

On unsafe leadership level, the most weak factors is rwlated with inadequate leadership, followed by inappropriate operation. While for two others factopr are not available in the analysis as seen on below diagram.



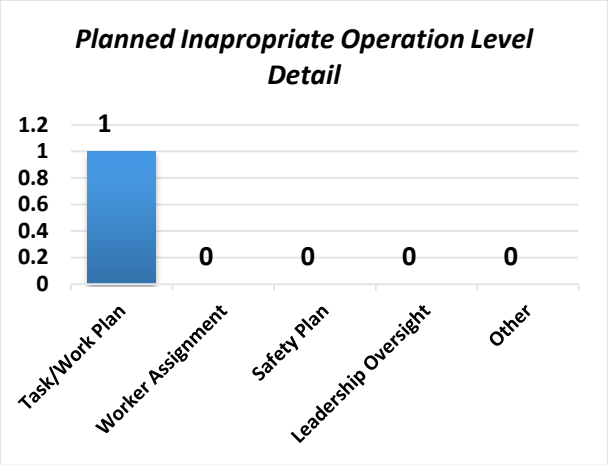
Inadequate Leadership. The weakness on this level are related with guidance and training. In term of guidance, the weakness is such a failure to give a proffesional guidance and supervisory to subordinate. For training, the weakness point is inappropriate of training which stated on procedure, exist regulation and policy. On this thing, training purposed in procedures, regulation and policy is not suitable with given training actual. Below is the diagram of distribution factor which become the weakness on this level.



For detail, we can see on the table below:

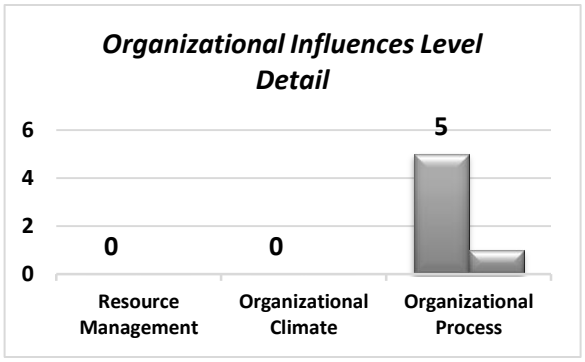
Inadequate Leadership	
Guidance	**Total**
Inadequate monitoring of work	1
Failed to provide professional guidance/oversight	3
Unclear or conflicting assignment of responsibility	1
Training	
Inadequate training on SOPs, policies, regulations	1
Leadership Knowledge/Skill-Level	
Leadership unaware of procedures associated with task	1

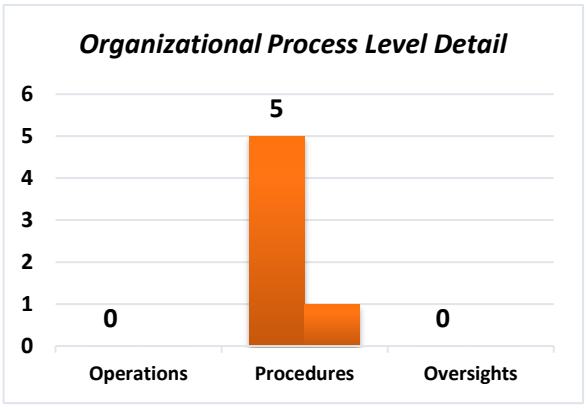
Planned Inappropriate Level. The weakness on this level is related with task/work plan such inadequate assessment about work needed or plan to a jon is not adequate.



Organizational Influences

From the analysis, the weakness on organizational level is on organizational process, while for resources management and organizational climate did not found on this research. Weakness on organizational process is such inconcistency of procedures, what is stated on procedures is not match with what employee conducted in field. Below is diagram for organizational influences.





Detail explanation:

Organizational Process	
Procedures	**Total**
Policy/standard guidelines not written	1
SOPs inconsistent with work practices	4

6. CONCLUSIONS

From result above, it can conclude that each level on HFACS system framework, have the weakness which impact either direct and indirect to accident in Geoengineering division during 2015. However, the basic things and important which often violate is the lack of risk assessment of job which lead to accident. On violation side, many still employee break the procedure such driving with unsuit velocity, break the traffic rules, break the procedures in company.

On the othe side, the weakness on precondition to unsafe level which affect to accident is related with ergonomics factor such limited movement while working, slippery road and inadequate safety guard installation. Its affect the accident occurrence direct and indirectly.

On the next level related with unsafe leadership, the weakness point are the failure of a leader to guide and inadequate supervisory when employee conducting a job.

The last level is organizational influences, the weakness point is inconcistency such inconsistency procedure implementaion, policy and regulation considered by company. The main thing is implementation of a job in the field was not appropriate with written procedure. This is directly impact to an accident. Therfore, safety behavior and safety culture need to develop and delivered to all employee and ensure all is understand about the procedure of the job conducted.

Suggestions

From the analysis result, below here are suggestion hopefully able to decrease the occurrence of the case in GeoEngineering Division in the future.

1. All employee obligate to conduct risk assessment prior to work. Risk assessment conducted to the human (physically and mentally fit, procedure understanding, competence, related training, etc), work environment (weather, ground support condition, underground mine condition, etc), used equipment (LV, tools, PPE, etc).
2. Geographic condition in mine with a difficult and heavy field are really difficult to control. Company had created the regulation to decrease and prevent the accident. Employee should obey all the rules such as obey the mine traffic, speed rules, vehicle operation, etc. By obeying all the rules it is hopefully to avoid accident. Employee is wished to understand

related to safety guard by participate on training. Adequate safety guard on equipment and machinery able to decrease and prevent accident. Limited movement when working is often found in the workplace. Therefore hopefully, conducting a job witj limited space must be a person who trained and had an adequate competence.

3. When an employee conducting a job, it is hped that supervisor had an active roles to give a supervisory and guidance to all subordinate proffesionally, in order all accident case decreased or even eliminated.
4. Organization must ensure that all employee understand the procedure of the job, in order the implementation can performed well. The way is by deliver a workshop or training related with procedure in each department. By understaning procedure, hopefully employee able to conduct a job based on proper procedure.

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Health Risk Assessment of Vapor-Phase Hydrogen Peroxide Exposure at A Milk Factory PT. XYZ Year 2017

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Abstract

H_2O_2 (Hydrogen Peroxide) has been widely used as sterilization substance due to its strong oxidation properties. Nowadays, especially in dairy industry, H_2O_2 is mainly used to sterilize containers. However, it was found out that long term exposure of H_2O_2 to workers might cause adverse effects such as irritations towards eyes, skins, and respiratory systems.

This research aimed to evaluate the potential health risks of H_2O_2 exposure to workers working at UHT milk packing process PT XYZ. Furthermore, several recommendations to minimize risk will be discussed. Chemical Hazard Risk Assessment (CHRA) method from DOSH Malaysia was used and assessing health complaints from the workers were identified using a questionnaire.

It was found that during observation, H_2O_2 exposure level at filling room and exhaust chimney were the highest, 1.50 ppm and 9 ppm respectively. The TLV-TWA ~~is~~ was 1.00 ppm. Dry and sore throat were the most common health implications experienced by the workers. Steam flows were proposed as an absorbent for H_2O_2 inside the chimney to reduce the exposure level. It was shown that the released concentrations of H_2O_2 from chimney were reduced from 9 ppm to 0.5 ppm after steam flows were implemented. Thus, it was recommended to improve air circulation and exhaust fan on filling machines to further reduce the H_2O_2 exposure level.

Keyword: Chemical Health Risk Assessment, CHRA

1. INTRODUCTION

At milk factory, PT XYZ, aseptic packaging is used for UHT milk. To enable the production of high quality product for extended time, hydrogen peroxide is used to sterilize packaging material. The purpose of this sterilization process is to eliminate most microorganism except bacteria's

spores [1]. Hydrogen peroxide is a sterilized agent which act as oxidator with strong oxidation properties, suitable to be used for this process. Hydrogen peroxide which is used by Milk factory PT XYZ is INTEROX AG Batch 35-S produced by Solvay. It was made specifically for aseptic filling machine because the stabilizer system has been optimized, so the evaporation process or spraying will be ideal and thus no chemical residue left on the materials, nozzle tools, roll and coil heater.

However, with all benefits provided by hydrogen peroxide for product, there are potential hazardous factors which might affect workers' safety and health. Those factors are chemical, physics, biology, ergonomics and psychology. When those aspects are ignored, the quality of work environment will decline and potentially lead to accidents and occupational diseases. Based on The American Conference of Governmental Industrial Hygienists (ACGIH), a TLV–time weighed on average (TWA) of 1 ppm (1.4 mg m^3) [2]. The value cited is, however, rather meager and some data obtained indicate that these threshold values do not provide the optimal protection for the workers. Rough skin on hands and decolorized hairs were observed in workers exposed to H_2O_2 concentrations of 1 ppm [3]. Based on the research conducted at PT XYZ, the H2O2 vapor exposure in the filling room area and vapor disposal in the chimney were found to be the highest with the average of H2O2 vapor measurement results in filling room area and chimney were 1.50 ppm and 9 ppm respectively. It is further strengthened by other research emphasizing the need of H_2O_2 concentration threshold range in filling room, "The source of risk was the exposure in the sterile chamber, although the time of exposure was approximately 30 min. The presence of symptoms among the workers entering the sterile room even for short period of time suggests that there is a need for a short-term exposure limit for H_2O_2" [4].

The result of questionnaires which are given to the worker showed that they experience eye, skin and nose irritation with some also claims experiencing respiratory disorder.

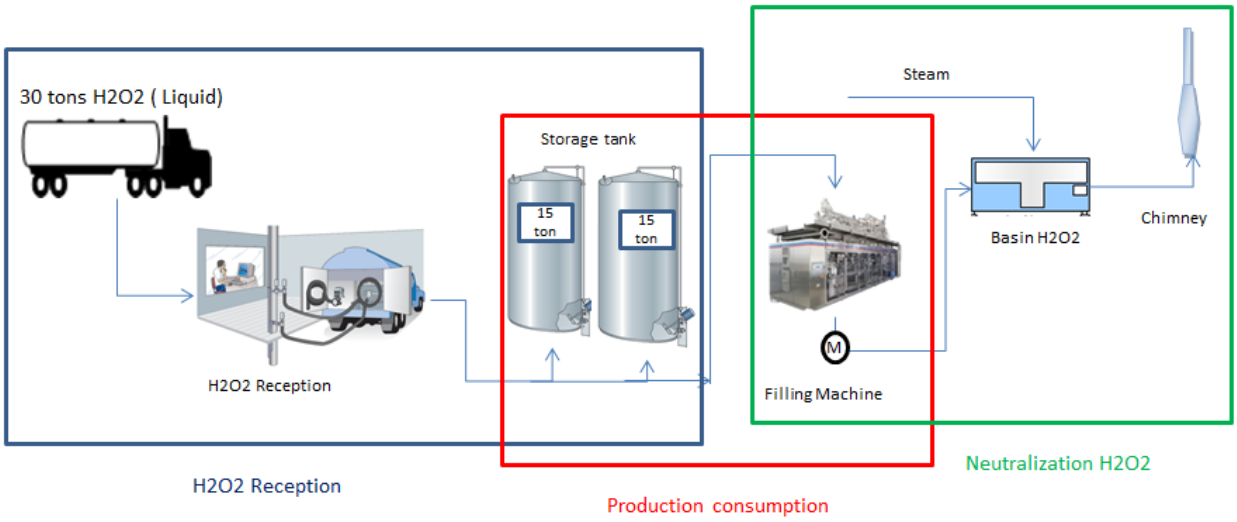
2. METHODS

This study was descriptive research by qualitative and quantitative analysis using CHRA from DOSH Malaysia. The collected data were results from direct observation, work environment

measuring, questionnaire, and company secondary data. Hydrogen peroxide process and flow on PT XYZ divided into 3:

1) Reception. The transfer processes of H_2O_2 liquid from supplier tank to storage tank.
2) The usage on production. Transferring hydrogen peroxide in liquid phase from storage tank to spray H_2O_2 vapor unto packaging material (sleeve)
3) Waste disposal to environment, the disposal of H_2O_2 residual which is used in production to the environment after neutralization process using water steam.

Figure 1. Flow Process of H_2O_2



Measurement of H_2O_2

The measurement of H_2O_2 concentrate was done using Dräger X-am 5100A Single-gas detector. It was made during maximal (full loaded) production load and was took in filling room area once a week together with up to 3 times repeatability on every disposal chimney. In filling room, samples point was chosen where workers perform their tasks for more than 5 hours, while on disposal chimney, samples were took 150cm from the opening.

Hazards evaluation

Hazards were evaluated using CHRA to protect worker from chemical effects. Determining the potential hazard of H_2O_2 for worker's health by observing, analyzing, and measuring

potential hazards to eye and skin contact or respiratory by identifying, evaluating and controlling every health risks that lead to work activity that using and contacting with H_2O_2.

1) Exposure Parameters → identifying worker activity that H_2O_2 exposure are possible. Start from reception, usage in production until waste disposal that cause hazard to worker's health.
2) Degree of Exposure
3) Frequency of Exposure → to assess acute effect of H_2O_2 exposure.

Table 1. Frequency Rating [5]

Rating	Description	Definition
5	Frequent	Potential exposure of one or more time per shift
4	Probable	Exposure greater than one time per week
3	Occasional	Exposure greater than one time per month
2	Remote	Exposure greater than one time per year
1	Improbable	Exposure less than one per year

4) Duration of Exposure → A duration rating was used to asses chronic or routine exposures. Duration of exposure also has a significant effect on the exposure

Table 2. Duration Rating [5]

Rating	Total Duration of Exposure*	
	% work hour	Duration per 8-hr shift or per 40-hr week
5	> 87.5 %	> 7 hrs/ shift or > 35 hours/ week
4	50-87.5 %	4 to 7 hrs/ shift or 20 to 35 hours/ week
3	25-50 %	2 to 4 hrs/ shift or 10 to 20 hours/ week
2	12.5-25 %	1 to 2 hrs/ shift or 5 to 10 hours/ week
1	< 12.5 %	< 1 hr/ 8 hr shift or < 5 hours/ week

Note: Total exposure duration per week (TD)

= (Number of exposure per week) x (Average duration of each exposure)

5) Intensity or Magnitude of Exposure → to determine the intensity or the amount of H_2O_2 exposure using 2 ways:
   - Quantitative Evaluation- inhalation exposure

Quantitative evaluation of exposure was carried out for inhalation exposures if air sampling data for the exposed employees were available. Where exposure data was limited or unavailable the assessor should assess the exposure qualitatively. The evaluation of inhalation exposure is without regards use respirators [5].

The activities that conducted by measurement were done in production area and at the site of waste disposal to environment.

- Qualitative Estimation of Magnitude of Exposure

The area where measurement was not made by tools, it was done by assessing the amount of exposure based on estimated absorbed dose through inhalation and skin absorption of H_2O_2. For this estimation we will look at the degree of chemical released or its presence and also the degree of chemical absorbed or likely to be absorbed at the exposure boundary [5].

Assigning Magnitude Rating (MR)

Table 3. Magnitude Rating [5]

Degree of release	Degree of absorption	MR
Low	LOW	1
	MODERATE	2
	HIGH	3
MODERATE	LOW	1
	MODERATE	2
	HIGH	3
HIGH	LOW	1
	MODERATE	2
	HIGH	3

6) Significance of Risk → This evaluation was used to see the effect of H_2O_2 exposure to workers' health. Its evaluation was divided into 2: significant and not significant. Furthermore, this evaluation can be used to identify and make priority of controlling strategy.

Table 4. Risk Matrix [5].

		Exposure Rating				
		1	2	3	4	5
Hazard Rating	1	RR =1	RR =2	RR =2	RR =2	RR =3
	2	RR =2	RR =2	RR =3	RR =3	RR =4
	3	RR =2	RR =3	RR =3	RR =4	RR =4
	4	RR =2	RR =3	RR =4	RR =4	RR =5
	5	RR =3	RR =4	RR =4	RR =5	RR =5

Risk Not Significant

Risk Significant C1

Category 1

Category 2

QUESTIONNAIRE

Questionnaire is a tool that is used to collect information from individual [6] about themselves or their environment [7]. This method was used to give insight on workers' complaint which directly contact with H_2O_2, this questionnaire was given to 23 workers.

3. RESULTS

From reception process, until waste disposal there were several hazardous factors observed that may affect workers' safety and health. Several physical hazards detected which caused by H_2O_2 35% were:

1) Respiratory system damage: Irritation to nose, throat and lungs with cough, choking or tightness as the symptoms.
2) Burn and stinging pain if skin is exposed, followed by inflammation such as itch and scaling
3) Red/Pink Eye (Conjunctivitis).

Measuring H_2O_2 were done at usage process in production and waste disposal to environment because the result of measurement in filling room area showed the H_2O_2 concentration was above TLV threshold, especially at filler area where the operator doing their

activity for about 6,5 hours of total working hours; 8hours. According to table 1 the average of H_2O_2 concentration at filler area was 1.7-2.2 ppm

Besides filling area, H_2O_2 concentration was also measured at waste disposal area. The residual hydrogen peroxide vapor that directly dispatched into the air can cause health problems to material loading unloading, WWTP, and CIP Central workers that work next to filling area and might also raise protest from local community because of the basic character of H_2O_2 which is slightly sharp and pungent odor.

H_2O_2 vapor concentration was measured by using gas detector at a distance of 0.5 meter from the opening of disposal chimney and the result was 8-10 ppm. Thus, H_2O_2 neutralization process before releasing to the air was needed. It was then proposed to neutralize H_2O_2 residual vapor using spray steam

There were significant differences detected between measurement results before and after spray system tool installed. Six chimneys with installed spray steam tool to neutralize H_2O_2 showed that vapor concentration which dispatched to the air were under 1 ppm. Spray steam tool was seen effective to decreased H_2O_2 concentration to meet appropriate ~~to~~ threshold value, 0.2-0.7 ppm.

Table 6. Concentration on the Production Area

Area	Concentration (ppm)	Remark
Filler 1	2	Production
Filler 2	2.1	Production
Filler 3	2	Production
Filler 4	2	Production
Filler 5	2.1	Production
Filler 6	2.2	Production
Filler 7	2	Production
Filler 8	1.7	Production
Sleeve Room	0.5	Production
BDT Room	0.3	Production
Control Room	0.3	Production
Panel Room	0.4	Production

Area	Concentration (ppm)	Remark
CIP Kitchen	1.5	Production

Table 7. Measurement Result in H_2O_2 Disposal Waste Area Before and After Spray System Tool Installed to Neutralize

Chimney	Concentration (ppm)		Remark
	Before Neutralization	After Neutralization	
1	8.2	0.4	Production
2	9.6	0.5	Production
3	8.4	0.7	Production
4	9.4	0.6	Production
5	8.4	0.2	Production
6	10.1	0.6	Production

According to CHRA Table, can conclude that every activity that done by operator at working place in PT XYZ have Risk Evaluation with "Risk Significant" Category as category 1 and category 2.

Based on the questionnaires given to the worker with direct contact activity with H_2O_2, the most common symptoms experienced were shore throat, with frequent cough in the second place. When filling the questionnaires, worker may choose more than one health complaint that they experience during the work so they have more than one symptom.

4. DISCUSSION

The measurement results of H2O2 vapor at filling area room was 1.50 ppm on average. It was higher compared to the threshold according to The American Conference of Governmental Industrial Hygienists (ACGIH) which states a TLV–time weighted average (TWA) of 1 p.p.m. (1.4 mg m3). The threshold value was supported by other study in beverage processing plant, where lung function was examined in workers exposed to airborne H2O2 at levels in compliance with the ACGIH TLV–TWA value (Mastrangelo et al., 2005). The study suggest that exposure did not

induce lung function changes. In spite of this, the workers at the plant reported widespread work-related symptoms from eyes and upper airways system, suggesting that the value was not sufficient enough to fulfill overall worker protection (G. MASTRANGELO,2009). Moreover, to ensure the total workers' health, deep analyze was needed to ensure interference that lead to respiratory system known. The collected primary research data were not complete yet in every work activity which directly contact with H2O2, especially in H2O2 reception area. The secondary data obtained from the results of yearly worker health examination and clinic visit at PT XYZ has not been analyzed yet to complete a comprehensive data of health impact of workers due to H2O2 exposure.

5. CONCLUSIONS

To sum up, it was clearly shown that the highest exposure of H2O2 vapor took place in filling room area and H2O2 vapor disposal chimney. The measurement results of H2O2 vapor on filling room area was 1.50 ppm on average and 9 ppm on average at chimney with the allowed threshold was only 1.00 ppm. Controlling method to reduce concentration on chimney was done using steam (water vapor), hence concentration of exposure to the environment was decreased from 9 ppm to 0,5 ppm. Based on the questionnaires filled by filling operator, health disorders which they often experienced were dry and shore throat. Recommendation to control filling room area was to repair air circulation and adding exhaust fan in every filling machine.

Reference

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